THE

ELECTRICAL REVIEW.

VOL. LXVII. JULY 22, 1910. No. 1,704.

ELECTRICAL REVIEW.

Vol. LXVII.] CONTENTS: July 22, 1910. [No. 1,704.

	Page
Home Office Regulations: What is a "Competent" Man? ...	121
On Exhibitions	122
Train Lighting	122
The Committee for the Protection of Electrical Interests ...	123
The New Channel Telephone Cable	123
The Franco-German Cable Agreement	123
A Proposed Association of Consulting Engineers	124
The British Metalite Lamp	125
Correspondence:—	
Co-operative Lighting...	125
Commutator Troubles...	126
Lightning Conductors...	126
Legal	126
Our Legal Query Column (*illus.*)	129
New Electrical Devices, Fittings and Plant (*illus.*)	130
Business Notes	130
Notes	137
Installation of Large Battery and Boosters at Dickinson Street Electricity Works, Manchester (*illus.*)...	139
High-Speed Rotary Converters (*illus.*)	142
City Notes	143
Market Quotations	150
Stocks and Shares	150
Share List of Electrical Companies	151
Exports and Imports of Electrical Goods during June, 1910 ...	153
Practical Notes on Illumination by Cooper-Hewitt Mercury Lamps (*illus.*) (*concluded*)	154
Proceedings of Institutions:—	
The Progress of Electric Braking on the Glasgow Corporation Tramway System (*illus.*)	155
Germany and Protective Duties: An Advocacy of Lower Imposts	159
Foreign and Colonial Tariffs on Electrical Goods	160
New Patents Applied For, 1910	160
Contractors' Column... ... Advertisement pages xxiv and xxvi	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 963; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 18s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Toronto, Ont.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOUTEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

HOME OFFICE REGULATIONS: WHAT IS A "COMPETENT" MAN?

In another column we give a report of a prosecution under the Factory Acts which is of considerable interest to the electrical engineering industry. When the new regulations were being discussed, before being issued in their final form, several objectors, including the Electrical Contractors' Association, thought it desirable to stipulate that none but competent persons should be allowed to undertake electrical work involving danger, and these suggestions are embodied in Regulation No. 28, which reads as follows:—

> No person, except an authorised person or a competent person acting under his immediate supervision, shall undertake any work where technical knowledge or experience is required in order adequately to avoid danger; and no person shall work alone in any case in which the Secretary of State directs that he shall not. No person, except an authorised person, or a competent person over 21 years of age acting under his immediate supervision, shall undertake any repair, alteration, extension, cleaning, or such work where technical knowledge or experience is required in order to avoid danger, and no one shall do such work unaccompanied.

The term "authorised person" is defined in the definitions to mean:—

> (*a*) The occupier, or (*b*) a contractor for the time being under contract with the occupier, or (*c*) a person employed, appointed or selected by the occupier, or by a contractor as aforesaid, to carry out certain duties incidental to the generation, transformation, distribution or use of electrical energy, such occupier, contractor or person being a person who is competent for the purposes of the regulation in which the term is used.

It appears from the evidence in the case that certain repairs or alterations had to be carried out on a high-tension switchboard carrying a pressure of 3,000 volts. The actual repair or alteration was carried out by an electrical engineer, the repair involving the fitting of a bush which had got loose, for which it was necessary to have a wooden wedge made. A competent joiner was employed to make the wedge, but, so far as the evidence goes, he had nothing whatever to do with the actual repair—that is to say, there was no need at all for him to come in contact with any portion of the switchboard, as the wedge was fitted by the electrical engineer whom he, the joiner, was assisting. Notwithstanding the fact that the joiner had been warned that the cables were alive, and that it was dangerous therefore to touch them, he by some means, not clear from the evidence, received a shock of 3,000 volts and was killed. It is important to note that the same joiner had been employed on similar work previously, and was therefore, no doubt, quite cognisant of the danger. According to the prosecution, the defending company—namely, the Newcastle-on-Tyne Electric Supply Co., Ltd.—had failed to observe the regulation "by permitting an unskilled man, not being an authorised or competent man, to undertake certain work," and, after hearing the evidence on both sides, the magistrates decided that the prosecution had established their case, that the joiner "was not competent for the work he had to do,"

and fined the company £10 and costs. The result of this decision means that a joiner who has served his time to his trade, and has probably had several years' experience in joiner-work, is not competent to carry out joiner-work when it is done in connection with high-tension switchboards. In other words, it means that no electrical work in which any danger is involved, and no work incidental thereto, may be carried out by any but a trained electrical engineer, or one having electrotechnical knowledge.

In view of the possibility of the case being taken to a higher court, the matter must for the present be treated as *sub judice*; we are therefore debarred from offering any comment or opinion on the verdict as it stands, and must content ourselves with merely drawing special attention to the case, so that in the meantime electrical engineers and contractors generally may fully consider the position.

On Exhibitions. Our readers know well enough that we believe in exhibitions when run on the right lines, at the right time, and in the right place. They give a fillip to trade and make for the expansion of industry. But here, as in everything else, we can have too much of a good thing. We have given our support to the great international exhibitions because we believe that they will help the growth of our foreign trade by letting the world know in what departments we are able to excel. It is essential nowadays that we be in evidence wherever our competitors are; if we are not, the world and his wife may go away with an impression which will not result to our advantage. It is unfortunate when events clash, especially when firms have neither enough spare cash nor a sufficiently large organisation to enable them to exhibit in two or three places at once. This year some firms are to be found at Brussels, some at Shepherd's Bush, and others are waiting for the Buenos Ayres Exhibition doors to be thrown open. All of these events are what the commercial man would call business-getting opportunities; but there are limits to our powers, and so it happens that there are very few instances of engineering or electrical firms being at all three shows, or even at two of them. We have got to reckon upon a larger annual outlay upon trade exhibitions in the future, however, and we may as well face the fact.

If business anything like commensurate with the outlay can be obtained at all places, why not alter our arrangements so as to be efficiently represented at all? This suggestion may meet with criticism at the hands of some of our readers: how can it be expected that we should maintain exhibition staffs in three parts of the world at once? who can expect us to allow so much plant and material to lie idle? how can we stand against the outlay? These questions are all familiar to us, but it is not for us to find the way out. If we cannot exhibit more frequently or in several places at once—well, we cannot, and there's an end on't, but let us be sure that it is impossible before we say so. Each individual firm knows its own manufactures, its own organisation, its financial abilities, the amount of its trade with other parts of the world, and the prospects of extending that trade. Let all of these factors be weighed together in order to see whether we have reached the limit of our enterprise. Then, if conscientiously we have done so, or if we are really too weak to do more than we are doing, let us settle down to the business that we have, and let everybody else mind his own affairs. But, wait! What is our organisation—can it be improved so that we can get more out of it than we do? What are our manufactures—have they no application in parts of the world that we have not touched? What are our financial limits—have we nothing more to spend upon a real forward policy? Let none dismiss the question as though they were tired of hearing of it, and drift along the even tenor of their way, for the matter has got to receive serious attention if we are going to continue to keep our heads up in the competition with our rivals. They show no hesitation in spending money and ability in this direction.

So far we have been alluding to exhibitions as an aid to the expansion of our foreign trade. There is another aspect which is clamouring for attention. As we have said at the beginning of these notes, it is possible to have too much of a good thing. How frequently ought we to run electrical exhibitions in the United Kingdom for the stimulation of the home electrical demand, and for familiarising the people with the latest advances in electrical development? We have received news from a correspondent to the effect that the holding of another electrical exhibition in 1911 or 1912 is being mooted in electrical trade circles in South-East Lancashire. Now, as a matter of fact, the National Electrical Manufacturers' Association is already organising an electrical exhibition on a large scale to be held at Olympia in September and October, 1911, and, to our way of thinking, and we believe we shall carry the vast majority of our readers with us in this, it would be nothing short of folly for the electrical trade to divide its attention between two large exhibitions, one at Manchester and one at Olympia, at about the same time. Let us all concentrate our energies upon the event at Olympia first; then we shall be ready at a later period, after a reasonable interval, to devote ourselves successfully to Manchester again. It is true that there is to be a mining exhibition in Manchester a month or two prior to the Olympia display, but this would probably only affect a small proportion of electrical firms, and these might feel it to be good policy to bring their exhibits on to Olympia, for electrical mining ought to have a place there too.

Train Lighting. We have often pointed out the danger involved by the use of gas for lighting trains, and the horrible sufferings inflicted upon the imprisoned passengers in the event of a collision; many instances are on record, both in this country and on the Continent, of persons being burnt to death through this cause in sight of their friends, who are powerless to rescue them. Yet the Board of Trade, while expressing preference for electric train lighting, which is absolutely safe and at least as economical as gas lighting, has taken no active step towards eliminating this risk. The Board waits upon public opinion, which is only aroused by the occurrence of disaster, too late to do more than prevent a recurrence; but surely it might bring pressure to bear upon the railway authorities to hasten the adoption of the illuminant which is free from the dangers of gas.

On the Continent some progress has already been made in this direction; the Austrian Ministry for Railways has been requested to discontinue the use of incandescent gas lighting, and to use electric light exclusively on all passenger cars on order or to be constructed in the future. This request, emanating from the Council of the Austrian State Railways, has been backed up by the daily Press, which quotes the numerous railway accidents which have occurred within the last eight months accompanied by gas fires and loss of life therefrom. The Government admitted that electric lighting presented economic advantages, and undertook that 110 new cars on order for 1911 should be electrically equipped. It was stated in the discussion that all the Swiss railways and the great French railways had decided to adopt the electric light in the future exclusively. Only last month a serious accident took place at Villepreux, when the train was burnt, and it was reported from Paris that the fire was due to the gas used for lighting.

In view of the unassailable evidence by which gas has been proved to be the cause of these terrible holocausts, it is interesting to observe that one of our contemporaries in the gas interest ascribes the reports to the "mendacities of the electricity propagandist."

The case, however, does not rest in the least upon *ex parte* statements, but upon official reports free from all suspicion of bias towards electric lighting. As the same writer suggests that metallic-filament lamps cost 4s. 3d. each, and last no longer than a three-penny gas mantle, his remarks may be dismissed as the product of a diseased imagination.

The Committee for the Protection of Electrical Interests.

We are informed that at a meeting of this Committee held on July 6th, a discussion took place regarding the procedure which is to be followed in the carrying out of its perplexing labours, as the result of which it was decided that the president (Hon. Arthur Stanley, M.P.), the vice-president (Mr. Robert Hammond), the hon. treasurer (Mr. Arthur H. Preece), and the hon. secretary (Mr. R. B. Matthews) should act as a committee of management. They have power to call meetings when necessary, and generally to prepare the business for the Committee. The last circular issued (see Electrical Review, July 8th, p. 80) stated that so many matters had already been brought before the Committee, that it would be necessary to make a selection of the more urgent for early attention. This we were quite prepared to believe, but the circular went on to ask for more difficulties to settle. The further letter that we have just received shows that nothing can assuage the thirst of this committee for problems to solve and difficulties to deal with, for it again asks those interested in the electrical industry to forward communications "with reference to any question that they may wish to bring before the Committee." We had supposed—presumably we were in error—that the founders of this Committee had pretty definite ideas concerning things that were wrong, without needing to issue a broadcast invitation to every Tom, Dick and Harry to conjure up a set of drawbacks or grievances, imaginary or real, petty or otherwise. We thought the Committee came into existence because things were wrong and because it meant to set them right, and here it is trying to find out whether anything, and if so, what, is out of order! Generally speaking, if you repeatedly ask a man to hunt around for trouble, assuredly enough he will find it. Yet, from the issuance of this second appeal we cannot help gathering that the grievances have not been coming in by every post. We learn that the president, himself a member of Parliament, is, by request, endeavouring to form an electrical party in the House of Commons, and he will welcome any suggestions from the outside rank-and-file as to the composition of the party. Some of our readers, who know the names appearing in the list of the members of this "Electrical Eighty Club," may think that the invitation to all and sundry to help in such a matter as this is hardly necessary. It may be that the invitation for suggestions is only issued as a courtesy to one and all.

The New Channel Telephone Cable.

We recently recorded the successful laying of the new telephone cable across the Channel. In another column we give some particulars of a comparative test upon the old and the new cables, which demonstrate the success of the experiment and the accuracy of the scientific forecasts of the Engineering Department of the Post Office. It is appropriate that the first deep-sea "loaded" cable should be made on the Thames and be laid from Dover's cliffs. Just 60 years ago the first essay in submarine telegraphy was made at the same spot. One of the conditions of the French concession being that communication should be effected before September, 1850, a single conducting wire covered with gutta-percha was sunk, by means of leaden weights, across the Channel. Its life was brief, yet long enough to serve the double purpose for which it was laid. It saved the concession, and it proved that gutta-percha was an effective insulating material, for messages were transmitted from coast to coast. The "iron bound" cable, containing four conductors, was laid in the following year (1851) with such success as to encourage the combined interests of science and commerce to extend their efforts to greater and greater lengths until the Atlantic itself was telegraphically bridged. It is due to the constructors of those days to record that in the materials and method of construction, the latest cable submerged follows very closely the precedent of its predecessor of 1851, except for one feature. At every nautical mile of its length there is, as it were, a protuberance representing the researches of Heaviside and the practical applications of Pupin, the effect of which is to permit the transmission of speech through a length more than three times as great as would be possible through a cable of similar specification but "unloaded."

The Engineering Department of the Post Office are to be congratulated upon the accuracy of the forecasts which they made, and the success which has attended the manufacture and laying of the cable. We may be sure that, following the telegraphic precedent which we have recalled, the new Channel telephone cable will serve as a stimulus to extend submarine telephonic transmission to greater and greater lengths, though in view of the extravagant expectations expressed by some of our daily contemporaries, it is necessary to remark upon the limitations for telephonic compared with telegraphic transmission with our present scientific knowledge.

The Franco-German Cable Agreement.

The agreement concluded between France and Germany for the mutual utilisation of submarine cables in the event of interruptions on either side is said to be closely associated, as previously announced in this journal, with a scheme for the establishment of a new cable connection between Emden and Brest, which was resolved upon some time ago, and is to be carried out next year. According to a German newspaper, Germany will place at disposal for this purpose the cable between Emden and Valentia, Ireland, which was thrown out of use on the opening of the first German Atlantic cable to the United States. The portion proposed to be used will be that leading to the mouth of the channel, whilst France will proceed with the extension thence to Brest. Two important international telegraph stations will be brought into direct communication by means of the cable. As is known, Emden has two direct connections, *viâ* the Azores, to New York, one to Vigo, Spain, and one to Monrovia *viâ* Teneriffe, the last of which is to be extended to Pernambuco, South America, in the spring of 1911. The French cable station at Brest also has two connections with North America, and one by means of a cable laid to Dakar a few years ago. In this way Germany and France would be rendered quite independent of the British lines in the future. It is, however, considered that the present agreement probably concerns chiefly the African connections, as both countries, in case of interruptions, have a great interest in the joint use of the lines if they do not wish to have to depend upon England. Moreover, the projected Emden-Brest cable is said to possess importance for direct traffic between Germany and France. The existing overhead lines are frequently subject to interruptions owing to the continual influences of the weather, which have already led to the complete suspension of the service, but these would be avoided by the direct cable. It is also asserted not to be out of the question that the South American traffic of France will later on be sent *viâ* Emden for further despatch, with slight delay, along the German South American cable, and this assumption is supported by the fact that on the inauguration of this cable the word rate between Europe and South America is to be reduced by 6d. A French authority, who participated in the negotiations for the conclusion of the agreement with Germany, is reported to have stated that the French were quite justified in liberating themselves from the expensive English cable monopoly, and that the whole history of the transaction was of a business character.

D

A PROPOSED ASSOCIATION OF CONSULTING ENGINEERS.

Several suggestions have been made during the past few years to form a Society or Association of Consulting Engineers, all of which, so far as can be seen, have ended in air. The subject has not, however, been lost sight of, and a few well-known consulting engineers have been endeavouring for some time past to formulate a satisfactory scheme. As a result of their preliminary efforts, these gentlemen formed themselves into a Provisional Committee, and invited a number of recognised consulting engineers to meet together at Caxton Hall last Wednesday week to consider and discuss the question of forming an Association. The meeting was presided over by Sir William Preece, who said that he was entirely in sympathy with the movement, and he assured those present of the sympathy of the Council of the Institution of Civil Engineers. Mr. Midgley Taylor, who occupied the chair pending the arrival of Sir William Preece, referred to the code of professional etiquette which had been drawn up by the Civil Engineers, saying that there was no doubt that was as far as the Council of the Institution could go. The object of this proposed Association was to go one better. The public wanted protecting.

At the present time, if municipalities erected works, even of large magnitude, they were not compelled to employ a qualified man to advise them, and there was nothing to prevent an absolutely unqualified man touting for and obtaining the work. The speaker thought that those unqualified men who endeavoured to take the work out of the hands of a qualified engineer, even after the appointment had been made, should not have the standing of members of such an Association as it was proposed to form.

Mr. James Swinburne formally proposed that the Association be formed at once. He pointed out that the rules of etiquette framed by the Institution of Civil Engineers, whilst good in themselves, really limited the powers of the genuine consulting engineer rather than helped him. He thought it necessary therefore that, whilst working in sympathy with the Institution of Civil Engineers, consulting engineers should form themselves into an association both for their own protection and for that of the general public, in so far as the interests of the latter were bound up with their own. It had been impossible in the case of the first meeting to make the list of invitations as complete as the Committee would desire, and the speaker hoped that those who had not been communicated with would understand that the Association was intended to cover the broadest possible field consistent with its objects, and that those corporate members of the Institution of Civil Engineers who were practising purely as consulting engineers would send in their names to the honorary secretary, Mr. A. H. Dykes.

It is unnecessary for us to refer to all the speeches that were made, as they were all to the same effect—viz., that it was highly desirable to form an Association of Consulting Engineers, which it was hoped—to use the words of the hon. sec.—would result in giving the public the same safeguards as they now have when they retain the services of a solicitor, a doctor, or an accountant.

Now we note that the majority of the speakers were electrical consulting engineers, and that in the Provisional Committee there are seven electrical, five civil, and three gas engineers, yet the great desire appears to be to conciliate and ally themselves with the Institution of Civil Engineers. It will be noticed from Mr. Swinburne's speech that electrical engineers are not invited to send in their names, but only "corporate members of the Institution of Civil Engineers," notwithstanding the statement that "the Association was intended to cover the broadest possible field." Why this taboo? That this is no unintentional oversight on Mr. Swinburne's part is obvious from the proposed rules, in which it is clearly laid down that all members of the Association must be corporate members of the Institution of Civil Engineers and also of the Institution representing the particular branch of the industry in which they practise. We entirely fail to see why a consulting electrical engineer who specialises, let us say, in the electrification of factories and workshops, should be compelled to become a corporate member of an institution representing a particular branch of engineering in which he does not practise. Granted that a number of electrical engineers are members of the Civils, this does not make them civil engineers, and it is a matter of grace or patronage on the part of the Civils rather than of the qualifications of such members, that they are admitted to corporate membership. The consulting electrical engineer, so far as we are aware, has no desire to poach on the preserves of the civil engineer; but we are not so sure that the opposite is not the case, for it would not be difficult to name a few well-known firms of purely civil engineers who have, within recent years, taken a considerable amount of work out of the hands of electrical engineers, work for which they have not the slightest qualification, and which they have not always carried through with the happiest of results. Electrical engineers complain when architects undertake electrical consulting work, but too often take it meekly when the competitor is a civil engineer. There are architects and civil engineers who are perfectly competent to undertake certain branches of electrical work, but what would electrical engineers say if a few architects banded themselves together and tried to impose the condition that all consulting electrical engineers should become members of the Royal Institute of British Architects? This, it seems to us, is on a par with the present attempt on the part of the Civils. We have every sympathy with the objects of the proposed Association, but we must ask for fair play for the consulting electrical engineers who have never posed as civil engineers and have no desire to do so. Why should the Institution of Civil Engineers be the only institution whose patronage and goodwill are sought? Why should not the Institution of Electrical Engineers, the Institution of Mechanical Engineers, and the Institution of Gas Engineers, all recognise the proposed Association of Consulting Engineers, and each Institution insist on the code of professional etiquette which has been framed and adopted by the Civils and adopted by the Electricals also? We do not wish to be thought antagonistic in the smallest degree to the objects of the proposed association; we think it is an association which is very much needed, and may do considerable service to the profession, but we can foresee that if there is any attempt to make it serve the interests of a clique, or coterie, instead of being a representative body of the profession generally, the result will be that other similar associations will be brought into existence for the benefit of specialised sections of the profession, the effect of which will be very largely to neutralise the aims and objects of the promoters, and to discredit the movement.

We are not sanguine enough to think that even under the best conditions such an association as is proposed will place the consulting engineer in the same protected position as the doctor and lawyer, as there is as yet no law by which a man can be prosecuted for practising as a consulting engineer without having the necessary qualifications, and notwithstanding the proposed association, there are men, as unscrupulous as they are unqualified, who will continue to practise and to tout with impunity.

Calcium Cyanamide.—The report for 1909 of the Gesellschaft für Stickstoffdunger, of Knapsack, states that the plant at Westeregeln was in operation during nearly the whole of the year, and the carbide which had to be taken over from earlier contracts was worked up into calcium cyanamide. Large quantities of the latter had to be placed in stock in consequence of irregularity in sales, thus causing a considerable outlay for interest, in addition to the cost of stocking. The plant at Knapsack was only occupied for a small portion of its capacity during the year, and this largely increased the cost of production. The Sales Association was able to record an increase of 35 per cent. in the turnover, but, unfortunately, so many new works had been established that their productive capacity exceeded the present demand, as agriculturists were only slowly turning to the use of the new fertiliser. The carbide market also suffered from heavy over-production, so that current prices no longer yielded profits to most manufacturers. The manufacture of sulphate of ammonia from calcium cyanamide, which was undertaken during the year, had not proceeded beyond large experiments, which were being continued. The results had shown an improvement, but were not yet satisfactory. The accounts show a loss, including the debit balance brought forward from 1908, of £12,900 on a share capital of £180,000. It is added that the spring business in calcium cyanamide this year has exhibited a considerable increase, although the disproportion between possible output and sales still exists.

THE BRITISH METALITE LAMP.

On Monday last a demonstration was given by the Bryant Trading Syndicate, Ltd., of the manufacture of the "British Metalite" lamps at their factory in Horsell Road, Highbury, in the presence of a large gathering of representatives of the Press; it was followed by a luncheon at the Hotel Cecil, at which Col. D. A. Kinloch, C.B., M.V.O., presided.

The lamp is of the tungsten type, and is very similar in appearance to others of this class; it is claimed that its efficiency is higher than that of any rival make, being 1·04 watts per candle (deduced by us from the statement that an 8-c.p. lamp gives 40 hours' light for 1d., at 3d. per unit). Actual tests by one of the largest electricity supply corporations in London are stated to have resulted in an average life of 2,226 hours on a batch of 13 lamps, while four of the lamps were still in efficient operation at the end of the test. Further claims are that it is "the first metallic-filament lamp to be manufactured in this country"; that in comparative tests against other makes "in all instances it has emerged the superior in every respect," and that it is "produced at a lower cost than any other metallic lamp." We are also informed that immense orders are being received from America and Germany, and that the contracts already in hand and in course of execution for America, in spite of an *qd valorem* import duty of 45 per cent., exceed 15 million filaments per annum for the next five years, while further orders have had to be refused owing to the present factory accommodation being already considerably overtaxed. The whole of the lamp is of British manufacture.

These statements are, of course, quoted on the authority of the Bryant Trading Syndicate, who may well be excused for congratulating themselves on having got hold of a really good thing! Their omission, however, to have tests carried out by one of the recognised independent institutions was rather unfortunate, and precludes us from expressing any opinion as to the qualities of the lamps. From the Syndicate's price list dated June, 1910, it would seem that the efficiencies range between 1·15 and 1·25 watts per candle, though a 100-c.p. lamp is rated at 100-110 watts.

The demonstration took the shape of an exhibition of "Metalite" lamps of many different sizes, in operation, and of apparatus and materials employed in their manufacture; Mr. Harrison, the inventor of the secret process used in making the filaments, which starts with tungsten powder and a binding material, squirted through a die, explained the leading features of the lamp, and answered many questions concerning it. We learnt that tellurium was used as well as tungsten, but was practically expelled from the finished filament.

The party afterwards inspected the processes of manufacture of the lamp in its various stages; the manufacture of the filament, however, was not shown. The filaments are welded to the supports in an atmosphere of hydrogen with a small electric arc, and the exhaustion of the bulbs, after being partially effected with a mechanical pump, is completed with rotary mercury pumps. The final process consists in flashing the filament to drive off occluded gases, which are removed by heating a particle of red phosphorus in the stem before sealing off. Hand work is mainly employed, though some labour-saving machines are in use. About 100 operatives, nearly all female, were at work in the four rooms that we visited.

The syndicate states that the present accommodation is totally inadequate to cope with the demands, and this we can readily believe, for the space available is of very limited dimensions, and several processes were in progress in each room. We are informed that a site has been inspected, and plans have been approved, for a factory 12 times as large.

Addressing the guests at the luncheon, Col. Kinloch remarked that the factory was far too small, a fault which, he hoped, would be remedied at an early date. Sir T. Brooke-Hitching, however, claimed that it was the largest factory in this country for metallic-filament lamps. Mr. Stuart said that the Bryant Trading Syndicate were the pioneers of the industry in this country, and Mr. Metcalfe, the managing director, said that the "Metalite" lamp beat other metallic-filament lamps by 15 to 27 per cent. Mr. Harrison, the inventor, who has been connected with the lamp-making industry for 25 years, stated that he had been at work on the metallic-filament lamp since 1906, and claimed that the syndicate now had the best lamp of this kind.

In the total absence of any evidence apart from the enthusiastic utterances of the directors of the syndicate and of the inventor, we are unable to express any opinion as to the merits of the lamp. The remarkable claims that they put forward are not likely to pass unchallenged by rival manufacturers. The works are small, and the present equipment is in many respects primitive, rendering a large output impossible under existing conditions. This, however, is not a material consideration, as everything must have a beginning. If success has been attained in spite of the difficulties of manufacture under such conditions, greater success may be confidently anticipated when suitable accommodation and equipment are provided, and we sincerely wish that the Syndicate, which makes a strong feature of the wholly British origin of its manufactures, may enjoy the prosperity which is its due.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Co-operative Lighting.

There are a number of cases in this town of consumers co-operating to form a circuit for arc lamps, and they have been working very successfully for about four years.

We do not use a current meter, but an hour meter, and we find that we get the best results, as regards obtaining early payment of accounts, &c., by rendering a separate account to each consumer for the number of hours the arcs are used, at his proportionate share of the total cost per hour.

In the first instance we used to hold one consumer responsible for the total; but although this is apparently the best and safest method, we prefer the first-mentioned arrangement.

Of course, it is necessary to get a separate application form signed by each party to the arrangement, and to give each one notice that in the event of anyone falling out the total cost must be borne by the remainder until another party can be found to fill the breach.

Shops on opposite sides of a street have been connected up by overhead wires.

W. H. Allen,
Borough Electrical Engineer.

Loughborough,
July 18th, 1910.

In reference to "B. E. E.'s" inquiry on the above subject in your issue of July 15th, I do not know of any particular installation where his suggestion has been carried out in practice. It is also a questionable point whether some supply authorities would not take exception to this particular method of supply.

I take it that in "B. E. E.'s" suggestion, each tenant would pay his proportional share of the total charges. This being the case in some instances, one tenant would have to pay his proportionate rate on occasions when he, perhaps, did not require the light, which would become rather a nuisance, or prove not an "unmixed blessing."

I think "B. E. E." would find it far better for each tenant to control his own lighting, as there are now on the market 5-ampere flame lamps specially designed to burn with a very high arc voltage. These particular lamps burn two in series quite satisfactorily, each lamp giving a maximum candle-power of about 4,500 and a mean hemispherical candle-power in the neighbourhood of 2,800. These lamps also possess the advantages of long-burning hours and low carbon costs, each pair of carbons (one trim) burning about 90 hours, and the carbon costs working out at about one-tenth of a penny per hour.

A 1.

July 16th, 1910.

Commutator Troubles.

May I with great respect be allowed to add to the remarks on this discussion, made by my good friends, F. Wiggins and Sons? It being a matter of absolute indifference to my firm whether pure mica or micanite be used for commutator insulation, my remarks on the subject may, I think, be considered unbiased.

From the experience gained by many years' close contact with electrical engineers whose hair is being, or has already, turned grey by the problems associated with this subject, I am of opinion that whether sections made of solid mica sheet or micanite be used, the strains and stresses to which this insulation is put are such as must sooner or later result in the edges of the material getting broken or chipped and the pieces being dragged or thrown out.

Your electrical engineer of to-day must have an insulator which is nice and soft, and which will wear evenly with the copper, and it is the process through which micanite is put in the course of its manufacture, and which renders it more soft and even wearing, that a preference in its favour must be put down to, and not "the mad craze for cheapness, &c."

There are, of course, two sides to every question, and whilst to some extent agreeing with Messrs. Wiggins, that there is a possibility of micanite giving off small broken pieces, after a certain amount of wear, this possibility is daily becoming less and less owing to improved methods of manufacture; and although this trouble is of necessity greater in the case of micanite than of pure mica, the advantages of softness and even wearing qualities in favour of the former in conjunction with the great saving in cost far outweigh anything that can be brought forward against it in favour of pure mica.

per pro. **D. Jaroslaw,**
L. Vandervelde, *Manager.*

London, E.C., *July*, 15*th*, 1910.

Lightning Conductors.

In "Lightning Conductors and Lightning Guards," page 50, Sir Oliver Lodge says, "No conductor is able to prevent side-flash altogether, unless it is zig-zagged to and fro so as to have practically no self-induction; in that case, the side spark is nearly stopped." On pages 47, 289 and 339 he describes, in detail, experiments showing the side-flash reducing effect of zig-zagged conductors.

Are we to suppose that Sir Oliver Lodge also has "totally mistaken its purpose and effect on self-induction?"

Alfred Hands, M.I.E.E.

London, E.C.,
July 18*th*, 1910.

[Our correspondent, in justice to Sir Oliver Lodge, really ought to have given the complete quotation. As he has not done so, we must:—"No conductor is able to prevent side-flash altogether, unless it is zig-zagged to and fro so as to have practically no self-induction; in that case the side-spark is nearly stopped. But so long as a conductor is straight (*and a lightning conductor must, of course, be straight*) so long will there be some tendency to side-flash, however thick it be made." The italics are ours. The fact is that Sir Oliver (on pp. 47 and 289) was dealing with a non-inductive conductor of tinfoil, 3 in. broad and 21 ft. long, doubled flat upon itself (or "zig-zagged") repeatedly, with paraffin paper between the layers for insulation, "so as to abolish self-induction as far as possible." On page 339 the reference is to a comparison between a non-inductive zig-zag of wire wound on pegs on a board, and the same length of wire carried round the room.

In the case of a tall chimney, the problem is to connect the top with the earth by a conductor having the minimum of self-induction; a straight conductor has less self-induction than a conductor of any other shape whatever, joining the same two points, and a broad thin ribbon has less self-induction than a thick rod. We did not think it necessary, last week, to state so elementary and well-known a proposition.—Eds. E.R.]

LEGAL.

The Attorney-General *v.* West Ham Corporation.

(*Continued from page* 92.)

Continuing, on Wednesday, July 13th, Sir Alfred Cripps said the plaintiff believed that there was outstanding to the present day a deficiency of revenue account which amounted to over £44,000. That amount had been secured by an illegal method of borrowing. Corporations were under a statutory obligation to pay their debts year by year, and if there was any deficiency to pay the debt out of the local rates. The debt was the ratepayers', and it was required that they should pay their way as they went along, because if that was not done the debt became a burden upon future ratepayers with which they were not concerned, and which they ought not to be called upon to bear at all. Persons who, for the time being, had the benefit of this electric light undertaking, should also make up any deficiency, and not leave it as a charge against future ratepayers. So far as current expenses and revenue were concerned, the Corporation had no power to borrow at all. The next Act in order of date with which he had to deal was the West Ham Corporation Act of 1893, which to some extent amended the Act of 1888, and then they came to the Act of 1893. That Act gave the Corporation power to purchase electrical fittings incidental to their supply, but it was important to bear in mind that any expense incurred by the Corporation under the sections of that Act was to be deemed an expense incurred under the Electric Lighting Act of 1882, where not otherwise provided for. Sec. 52 of their provisional order of 1892 gave the Corporation power to borrow, but only power to borrow in accordance with that section. It could only be done as a charge on the local rates with the sanction of the Local Government Board. He did not find that those powers were ever exercised, or purported to have been exercised, in respect of the amounts of which the plaintiff complained. Coming to the way the accounts had been kept, counsel said there was some slight difference between the parties as to the figures, but he thought it would appear that the accounts up to March 31st, 1908, showed that the electric lighting account had been overdrawn to the amount of £44,952 12s. There were other sums amounting to £90,000 odd, and at that time the Corporation had got an overdraft without authority of £148,671 odd. According to the bank, they had lent nearly £150,000, which was wholly illegal.

His Lordship asked how the electric undertaking accounts were kept. Were they balanced each year?

Sir Alfred Cripps said they were made up each year to March 31st.

His Lordship said then he could know whether there was a profit or loss. The accounts so far had not shown that. All they had shown was that the Corporation had overdrawn the electric lighting account. It was important, as it might be that there was sufficient to pay off the overdraft each year.

Sir Alfred Cripps said he did not think that his Lordship would find that was so. What he would find was that after the matter had been considered by the Finance Committee a communication was made to the bank with reference to this overdraft, the amount of which was very large indeed.

Mr. Justice Neville said he thought he understood the nature of the case, and from remarks that had fallen from Mr. Danckwerts he gathered that the parties were not really agreed as to the facts. Under those circumstances was it possible to proceed with the case until the accounts of the Council had been taken?

Sir Alfred Cripps thought so. There would be sufficient to explain what the course of dealing with the funds had been which would enable his Lordship to determine the principal question.

Mr. Danckwerts suggested that it might be more convenient to take the accounts first, but his Lordship said that if Sir Alfred thought there was a question to be determined first he must hear the case.

Sir Alfred, continuing, contended that it made no difference whether the loan was for a limited time or continuous; for if the overdraft was removed from time to time the Corporation were working upon what the plaintiff said was an illegal overdraft. Dealing at length with the correspondence counsel submitted that it showed the overdraft was being used for revenue purposes. He submitted that the Corporation could not borrow in the way the correspondence showed that they had borrowed. They could not borrow generally under their powers to borrow. They must borrow for a specific purpose, and, having obtained powers to borrow for that specific purpose, they could not use the money for another purpose. For instance, they could not obtain power to borrow for their tramway undertaking, and then apply the money for electric lighting. Further, he submitted that without putting themselves in a position to raise money by permanent loan they could not raise it by overdraft. According to the minutes of the Bank the overdraft was for the general purposes of the Corporation. They showed that the whole position was brought to the notice of the Bank, and the Bank was cognisant of all that was going on.

His Lordship put the case of where the Corporation had been authorised to borrow, but were advised by their broker that the state of the money market made it inexpedient to borrow at that time; and, consequently, went to the bank and asked for a temporary overdraft. That, he suggested, would be legitimate.

Sir Alfred thought not, except as a temporary expedient.

His Lordship said he was putting it as a temporary expedient.

Counsel said that his case was that what the Corporation had done was not done by way of temporary expedient, but by way of continuous overdraft. They could not, as against illegal borrowing, take advantage of the Consolidated Loans Fund. A great part of

the overdraft here was for expenditure that had not been sanctioned at all. Whether or not the Corporation could be entitled to borrow in anticipation of obtaining powers to do so, there could be no authority for setting the balance of the loans fund against unauthorised borrowings. Here, in the words of the reported case, the Corporation had not merely a temporary borrowing but a normal floating debt, and the whole of the authorities were to the effect that such a debt was illegal.

Speaking broadly on the authorities his contention was that the Corporation had no power to arrange for an overdraft apart from the consolidated fund except for purely temporary purposes, and that the pooling of the accounts was absolutely illegal and could not be justified. The present case practically related entirely to the electric lighting account, and it would not in evidence be necessary to go into the other accounts in anything like detail, but it would be necessary to refer to them for the purpose of showing how the accounts of the Corporation were kept and the general impropriety.

MR. LEON KEEN, chartered accountant, was then called for the plaintiffs, and said that he had been in practice as an accountant for 27 years, and had largely had to do with accounts of Corporations. For the plaintiffs he had investigated the accounts of the West Ham Corporation for three years—from April 1st, 1905, to March 31st, 1908. For the quarter ending March 31st, 1908, it appeared that on the electrical fund revenue account there was an overdraft of £44,952 12s., and that the capital electrical account was overdrawn to the amount of £92,452 4s. 4d. Those figures appeared in the published accounts of the Corporation. Some £1,500 odd was deducted from the £92,452, but in his opinion it ought not to have been, as it was money for a special purpose, and should have been carried to a special account. The revenue account included all the expenses relating to the manufacture and supply of electricity. It represented the expenses over the revenue obtained from the supply of current; of that, £4,669 was for expenses incurred in the year 1906, and was charged to the net revenue account in 1908. Stores in hand, £22,000 odd, was only another way of saying that the Corporation had borrowed from the bank to pay for those stores. The same thing applied to the motors. They were paid for out of the overdraft. The electrical accounts always showed an overdraft on revenue. The lowest was £28,000, and from 1907 it had always been over £40,000. The £92,000, overdraft of electric lighting capital account, was an amount that had been accumulating. It started at £12,000, and went up to £16,000, £17,000, £18,000, £25,000, £26,000, £40,000, £46,000, £63,000, £70,000, £86,000, £89,000, until in 1908 it reached £92,000.

On the resumption of the case on Thursday (July 14th), MR. KEEN, in cross-examination, said, in answer to MR. DANCKWERTS, that he had been given access to every document he had wished to see. There was nothing in the books of the Corporation to show that they were otherwise than well kept, and throughout the Corporation's accounts were audited by an eminent and independent firm of chartered accountants.

COUNSEL asked whether, apart from any question of alleged illegality, his investigations disclosed anything in the nature of misappropriation?

MR. KEEN: Oh dear no.

SIR ALFRED CRIPPS: The plaintiffs have never suggested anything of the kind.

MR. DANCKWERTS said he was obliged for that admission.

In answer to MR. BUCKMASTER, for the bank, WITNESS said that there was nothing in his examination of their books and papers that would enable him to say that the bank must necessarily have known the source from which the moneys paid into the Corporation's general account came, or the purposes for which moneys were drawn from the account.

This concluded the plaintiffs' case.

His LORDSHIP intimated that he would like to hear what the plaintiffs had to say with regard to defendants' application to amend by pleading the Public Authorities Protection Act.

SIR ALFRED CRIPPS submitted that it was now too late to admit of such an amendment, and if any amendment was allowed it ought only to be on terms.

His LORDSHIP said it could, of course, only be on the terms of the defendants paying the costs and the plaintiffs having the opportunity of calling further evidence to bring the allegations up to date. He would, however, hear how the plaintiffs put their case on the present materials, reserving the question of the defendants' right to amend to be dealt with, if necessary.

MR. MACMORRAN then summed up the case for the plaintiffs. The electrical undertaking of the Corporation, he said, was a separate trading concern, and that being so, the Corporation were required to keep and publish separate accounts in respect of it. It had been proved that the Corporation had overdrawn both the capital and the revenue account. On the face of it, therefore, there was something that called for an explanation. They found that the overdraft both of capital and revenue was not covered by any sanction to borrow on any statutory authority.

His LORDSHIP: With regard to the electricity there was not.

MR. MACMORRAN said they had to proceed upon that state of things. The Corporation kept separate accounts of their different undertakings, and the result as regards the electricity account was as he had stated. It had been suggested that there might be some power to borrow with regard to the capital account, but it could not be suggested with regard to the revenue account, for there the Corporation had to provide for the expenses out of the district rate. It could not be said that there was a sanction for this overdraft, because there was enough money to meet it out of the general district rate, for the money had not been so applied. The money was represented by motors, fittings, &c. In other words, they had borrowed money from the bank to buy motors and fittings, and by doing so they had contracted an illegal debt.

MR. JUSTICE NEVILLE: Assume the borrowing for electricity was *ultra vires*, you had to consider what was the result. You could not restrain them borrowing without the sanction of the Local Government Board that which was already borrowed. He supposed all that could be done was to restrain further borrowing.

MR. MACMORRAN said if it was an illegal borrowing, then it was an illegal debt. It was not merely *ultra vires*, but it was a thing that was illegal for them to do. That being so, the Corporation had no power to apply any money in their hands for payment of such a debt.

MR. JUSTICE NEVILLE: But supposing that they had done it?

MR. MACMORRAN submitted that in that case they would have to repay it. It might have to go further and make some persons personally responsible. With regard to the interest on the money, there could be no question that if it was borrowed without express sanction the interest ought not to be paid.

MR. JUSTICE NEVILLE: Assuming you are entitled to an injunction, what do you say as to the rest of the relief?

MR. MACMORRAN said that if originally illegal no subsequent act in paying off the money could legalise it.

MR. JUSTICE NEVILLE said he saw some difficulty in the form any order ought to take. The only way the Corporation could put themselves right was by levying a rate for the purpose, and he was not sure that they could legally levy a rate.

MR. MACMORRAN pointed out that the Corporation had sources of revenue other than the rates. It was sufficient for the plaintiffs that this debt was illegally incurred, whatever the consequences might be that followed from it. He submitted that the money must be put back somehow. If the bank gave this loan with the knowledge that it was illegal, then the bank was liable. From the way the accounts had been kept it was clear that the bank had had notice that there was a large overdraft in respect of the electricity account.

At this stage the hearing was adjourned.

On Friday MR. DANCKWERTS opened the case for the defendant Corporation. The case against them, he submitted, had been founded upon mere technicalities, and the Attorney-General, representing ratepayers, had disregarded the substance of things. The plaintiffs' own accountant had admitted in cross-examination that there had been nothing in the nature of dishonest dealings, and the overdraft at the bank had been treated by the drawing of cheques in favour of the lawful creditors of the Corporation. What had really happened was that by arrangement the Corporation had got the bank to pay their creditors. They had done nothing more than, for the sake of convenience, to transfer the debt from one creditor to another, and that, he submitted, they were perfectly entitled to do. The Corporation were advised that during the period under discussion—the period during which this overdraft was created—it would be inexpedient to go to the stock markets to raise money. They suffered in that respect, and also in consequence of the extraordinary delay on the part of the Local Government Board in giving their sanction for the raising of certain necessary loans. Under these circumstances, what was the Corporation to do? Their affairs could not be allowed to stand still, and creditors had to be paid. The only practical thing for them to do was to go to the bank and get them to pay the creditors. With regard to the Consolidated Loans Fund, he submitted the Corporation had the right to lend themselves the money pending the sanction they were expecting to get from the Local Government Board daily or even hourly. He should ask the Court to say that the Corporation in no way deserved the castigation sought to be inflicted upon them, and that technicalities could be pressed too far. No harm had been done. The action was supposed to be taken in the interests of the ratepayers, but it would have just the reverse result. This was unnecessary and expensive litigation which had been started by people who could not hope to benefit at all by it.

MR. PATTERSON, treasurer to the West Ham Corporation, was called for the defence, and in answer to Mr. Danckwerts, gave in detail the methods by which the Corporation's accounts were kept and the application of the overdraft to the various purposes for which it was used.

On Monday, in cross-examination by SIR ALFRED CRIPPS, he said that in 1906, the authorised loan was £94,026. It was true that at that time they were negotiating with the bank for borrowing £200,000, and that was partly for the electricity account and partly for the education account. When the letter was written to the bank on January 23rd, 1906, the total sanction obtained for loans amounted to £94,026.

SIR A. CRIPPS: And you had no other sanction.

WITNESS: No other sanctions, but we had borrowing powers outside the sanctions. The Board of Education required £26,093.

COUNSEL: Were you not asking to borrow £200,000 on general account?

WITNESS said that the £200,000 included the Education account, and the Corporation had borrowing powers outside the Acts. These borrowing powers were not exhausted at that time. Of the money the Corporation were then getting from the bank, part was spent on electricity, but witness did not know the exact amount. They set off against the general district fund what was overdrawn on the electricity account. There was always a substantial working balance left over from the district rate. It was always looked upon as a working balance for the whole of the accounts of the Corporation. For the year ending March 31st, 1909, the estimated charge on the district fund for the electrical undertaking worked out at £46,669 odd. The Corporation had included in the general rates sums for the payment-off of the overdraft.

Do you think it is right for any purpose to mix up the district

fund account with the borough fund account?—Theoretically no, practically yes.

Could you have properly taken any part of the borough fund for electrical purposes?—No.

Witness, further cross-examined, said that in March, 1910, the overdraft for electricity was revenue account, £35,000 odd; capital account, £57,000 odd. Substantially, since 1903 up to 1907 the rates had been 10s. in the £.

Was not your real difficulty in raising money that your rates were so high?

Witness said that was not the real difficulty.

What were you paying the bank for the money you were borrowing from them?—4 per cent.

And what rate of interest were you crediting the loan account?—4 per cent. Continuing, Witness said the interest on the consolidated loan fund was 1½ per cent. below bank rate; at that time the bank rate was 3 per cent.

So that you were paying on the consolidaded loan fund 1½?—We were up to March, 1908.

Witness further said that the electricity undertaking was started in 1904. He did not know that the relators in this case were paying £7,000 a year in rates, but he knew that they were very large ratepayers.

Re-examined, he said that there was no truth in the suggestion that the Corporation had kept property out of the assessment.

This concluded the evidence for the Corporation, and Mr. Buckmaster proceeded to open the case for the bank. The money obtained from them, he said, had been used for the purpose of keeping the electrical undertaking going, and it was in evidence that the electrical undertaking could not have gone on without this money being raised. There was no evidence that the bank knew the way the money was being expended. The statement to the bank was that it was necessary to keep things on foot, to pay the people who had done the work and the people who had supplied the goods. Either the Corporation had to pay these expenses, or the creditors had got to go unpaid. He submitted that these were legally incurred debts for a lawful undertaking, for there was no question that the electric light was a lawful undertaking. The debt to the bank was given by the Corporation for its authorised undertaking, and was honestly incurred in persuance of a lawful undertaking they had. It was necessary for the continuance of the undertaking that the creditors should be paid, and that to the bank whose money had paid them the money must be refunded. It could not be right that the ratepayers should enjoy this undertaking financed by the money of the bank, and then leave the bank unpaid. In conclusion, he contended that all the bank had done was to lend a sum for which they knew the Corporation had borrowing powers, and they could not be held responsible if the Corporation had applied the moneys for purposes for which they had no borrowing powers.

On Tuesday Sir Alfred Cripps replied on the whole case, and, in the course of his reply, said that he had consulted with Mr. Buckmaster, and for the present was willing to leave the case against the bank where it was. His Lordship would understand that what the plaintiff was anxious for was a declaration that the course of conduct of the Corporation was *ultra vires*. His submission was that the Corporation should obtain their borrowing powers before they incurred the expenditure.

In the course of the reply, terms were arranged as regards the bank. It was agreed that upon payment by the bank to the Corporation of £7,000 in respect of the interest paid to the bank on the balance of the overdraft, and on the bank agreeing to pay the plaintiff's costs as between party and party, including the indemnity costs, all proceedings against the bank should be stayed. The £7,000 was to be placed to the credit of the Corporation at once.

Mr. Buckmaster desired to point out that though the bank had come to this agreement for the purpose of saving embarrassing inquiries, they in no way admitted any liability.

At the conclusion of the reply, his Lordship said he thought it was a case in which he had better put his judgment into writing, and judgment was accordingly reserved.

Freeman & Sons *v.* Middleton Electric Traction Co., Ltd

On the 14th inst. Mr. Justice Hamilton resumed the hearing at the Manchester Assizes of a claim by plaintiffs, contractors, of Hollinwood, for £1,699 in respect of extra work done for the defendants, in carrying out a contract, the tender for which amounted to £38,781. Mr. Sutton and Mr. Acton represented the plaintiffs, and Mr. Horridge, K.C., and Mr. Hills the defendants. In the statement of claim it was set forth that Mr. Angus, who it was contended had been appointed resident engineer, had given orders for extra work to be done amounting to £6,843, and that had been paid less the sum of £1,699 now claimed.

Mr. Horridge, for the defence, argued that Mr. Sellon, the chief engineer of the defendant company, was the person to decide what were extras on the contract. Mr. Horridge submitted he had no case to answer, but his Lordship overruled this.

Mr. Sutton said their cause for action was that the defendants had refused to go to arbitration.

Mr. Sellon, the chief engineer of the defendant company, said he had never sanctioned the appointment of Mr. Angus as resident engineer, but in cross-examination, he admitted he passed the figures for payment of work done by the contractor, less 20 per cent., held back as retention money.

On Friday the hearing of the action was resumed. In the course of the proceedings, Mr. Sellon said he assumed that during the construction of the tramway he had been on the job some 20 or 30 times

The Judge gave a lengthy judgment, in which he said that Mr. Angus was never anything but a resident engineer, the deputy of Mr. Sellon, appointed to assist him, and not to relieve him of any of his duties under the contract. There was no evidence to satisfy the Judge that Mr. Angus was the engineer to give orders in writing under the clause of the agreement, which dealt with those matters. He therefore gave judgment for the defendants. He did not, he said, think the plaintiffs had been very well treated, and naturally, sitting as a juryman, he would be inclined to say that judgment should be without costs. But he had come to the conclusion that if he said judgment would be without costs it would only be because he was sorry for the plaintiffs; that seemed to be an insufficient judicial reason, and therefore he gave the defendants their costs.

In reply to Mr. Sutton, the Judge said he would not grant a stay of execution.

Factory Act Prosecution.

At Houghton-le-Spring Petty Sessions, on the 14th inst., the Newcastle-on-Tyne Electric Supply Co. were summoned on two charges under Sec. 28 of the Factory and Workshops Act, 1901. Mr. H. S. Mundahl, instructed by Mr. R. Sheriton Holmes, Newcastle, on behalf of the Director of Public Prosecutions, appeared for the prosecution, and Mr. W. S. Burton represented the Supply Co.

Mr. Burton took a preliminary objection on the ground that words had been imported into the summons that did not appear in the section of the Act, and that the particular summons with which they were then concerned did not disclose an offence.

Mr. Mundahl replied that the information was that a certain man died by reason of the defendant company having neglected to observe the regulations in pursuance of the Act, inasmuch as they failed to comply with the regulation by permitting an unskilled man, not being an authorised or competent man, to undertake certain work. After some discussion, the Bench decided that the case should proceed.

Mr. Mundahl said the defendant company were the owner of works for manufacturing, transferring, and distributing electricity at Philadelphia, and on April 15th they had occasion to employ Walter Patterson Liddell, a joiner, in a kind of passage between the switchboard and the wall of the building. He understood that there was about a yard space between the board and the wall. On the morning in question Liddell went in with an electrical engineer, named Archbold, who was going to do something in connection with the conductors. Archbold was going to fit in a bush which had got loose, for which Liddell had made a wedge. By some means or other Liddell came in contact with one or other of three conductors, and he received a shock of 3,000 volts, with the result that he was killed. There could be no doubt that Liddell met his death while he was engaged on the work at the back of the switchboard, and that he was killed by a shock of electricity in consequence of coming in contact with some of the conductors containing a very high charge of electricity. He urged that Liddell was not a man of technical knowledge or experience adequate to avoid danger. Liddell was employed by a Mr. Wardroper, and was permitted, as he (Mr. Mundahl) had said in the information, by the company or their officials to go into the place referred to, and to be exposed to danger where practical knowledge or experience was required to avoid danger. It might be that Liddell was handing something to the electrician—they did not know exactly what happened, but what the prosecution urged was that the deceased was allowed to engage in work where technical knowledge or experience was required to avoid danger. It might be said that the conductors were insulated, and that certain precautions were taken to render them as harmless as possible, but insulation or not, the man was killed, and he submitted that an offence had been committed by the defendants having failed to take adequate steps to prevent the deceased from engaging in the work referred to.

Mr. Burton: My point is that Liddle was a competent joiner, was 31 years of age, was in full possession of his faculties, and to that extent, was on April 15th electrically competent and, therefore, fulfilled all the requirements of the Act. Mr. Burton contended that the deceased was electrically competent by the knowledge imparted to him by persons at the works and by warnings given him.

Mr. Mundahl said the only question for the bench was—Was the deceased competent, a competent man where technical knowledge or experience was required in order to adequately avoid danger?

The depositions taken at the Coroner's inquiry into the death of Liddell were put in.

Mr. Burton, for the defence, said it had not been proved that the deceased was not competent, and therefore, *prima facie*, the prosecution had not made out a case in respect of that summons.

George Wardroper, contractor, Penshaw, said the deceased was a competent man as a joiner, and had been employed at the Philadelphia power station for three weeks.

Ferdinand Fawcett Pyle, engineer-in-charge of the power station, said that Liddell had to get permission from witness before he could work at the western switch chamber, where the fatality occurred. The passage referred to was not exactly a passage, but was the inside of the chamber. One-half of the chamber was occupied by the switchboard. Liddell was under the charge of Archbold, and was doing work in the western chamber similar to what he had done in the eastern chamber, the chambers being alike. Witness told Liddell that he must not touch the insulated conductors. The conductors were distinctly painted yellow. Witness told deceased they were "alive," and that a chisel or any sharp tool might cut through the insulation,

PERCY H. ARCHBOLD, with whom deceased was working, said Liddell handed him a wedge to complete a job.

MR. MUNDAHL: You thought it was necessary that this man should be warned?—Yes.

Unless he was warned there was danger?—Yes.

If he had the technical knowledge and experience of a competent man, why was it necessary to warn him?—He might have forgotten.

MR. MUNDAHL; The warning suggests that the man had no knowledge.

MR. BURTON (to Witness): My friend put it to you that there was danger, I suggest that it was nothing more than a risk, and that apparently the insulation was sound.—That is so.

JAMES CUSWORTH, chief engineer of the co-operative department of the Newcastle Electricity Supply Co., said the switchboard was of the latest type, and the insulation of the conductors the best that could be used. All that Liddell required to know was that the conductors were "alive," and that there was risk if he came into contact with them with tools. If they were unable to employ a joiner in such circumstances as Liddell was employed in, there would be unreasonable and serious interference with their business, as they supplied collieries with electricity day and night.

MR. BURTON asked the Bench to find, in the first place, that Liddell was competent, and that, in the second place, the company had done all that was reasonably necessary to provide against the man meeting with any sort of accident. He submitted that the company was clearly justified in employing Liddell, having regard to all the circumstances.

The Bench retired, and on returning into Court MR. R. RICHARDSON, the chairman, said the Bench found that Liddell was not competent for the work he had to do, and they, therefore, fined the company £10 and costs.

MR. MUNDAHL said they had brought the case to get a definition of the word "competent" for the public benefit, and did not ask for costs.

MR. BURTON said he might be instructed to take the case to a higher court, and the magistrates, in the event of an appeal, fixed the recognisances at £100.

MR. MUNDAHL said he would not proceed with the second summons.

SMITH *v.* WITNEY ELECTRIC SUPPLY CO., LTD.

IN the Chancery Division on Friday last, Mr. Justice Swinfen Eady, on the motion of the plaintiff in this debenture-holders' action, appointed a Receiver of the company.

MR. CLAUSEN, for the plaintiff, said the company was incorporated in 1899, and in 1902 created an issue of debentures. The interest was not in arrear, but the case was one of jeopardy. The business of the company was now being carried on at a loss, and the company would not be able to pay the interest due in December or to pay off the debentures that fell due then.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"STREET LIGHTING" writes:—"As our street-lighting contract will shortly be coming on for renewal, and as we shall, in all probability, be in competition with the local gas company, we should esteem it a favour if you would explain in your 'Legal Query Column' the following:—

"1. There are on this U.D. Council three gas directors, and possibly three or four gas shareholders. Are these gentlemen legally entitled to a vote as to whether electricity or gas should be adopted when the tenders for street-lighting are submitted?

"2. Further, assuming that we should not be put in competition with the gas company, would it be in order for these gentlemen to vote against a certain sum being paid to us for the illumination of the streets?"

*** The first question can be answered by reference to some Acts of Parliament, which provide that members of borough and county councils are prohibited from contracting or being interested in contracts with their councils by the Municipal Corporation Act, 1882, Sec. 12. But a person is not disqualified by reason of having a share or interest in any company which contracts with the council for lighting or supplying water. In the case of urban and rural district councils (it is understood that the council referred to in the query is an urban district council), members of these bodies are under a somewhat similar disability; a member is not disqualified for being elected by reason of being interested "(*c*) in any contract with the council . . . as a shareholder in any joint stock company; but he shall not vote at any meeting of the council . . . on any question in which such company are interested, except that in the case of a water company, or other company established for the carrying on of works of a like public nature, this prohibition may be dispensed with by the county council" (Local Government Act, 1894, Sec. 46). This would seem to answer the first query.

As to the second, this would seem to be covered by the same section of the same statute, as the gas company would clearly be interested in the streets being lit by electric light.

"TELEPHONE INQUIRY" writes:—"A has telephone concessions in towns and municipalities C and D, with Government concession to trunk between the two cities.

"B has only a Government concession to trunk from C to D, with a call-office or centre in each town, and has been refused leave by the Town Councils in C and D to make any derivations from his system or centres inside either municipality to any subscriber, and only has the right to one centre or call-office in each town (centres marked E and F).

"B rented a metallic circuit to H in C town and to J in D town (to speak directly to each other), without leave from the Town Councils.

"From the house of H two wires run and join the main trunk of B inside the municipality, and run direct on B's post to D town—J's house in D town. NOTE.—Neither H nor J has any Government or Town Council leave to make the connection himself or accept it from B company.

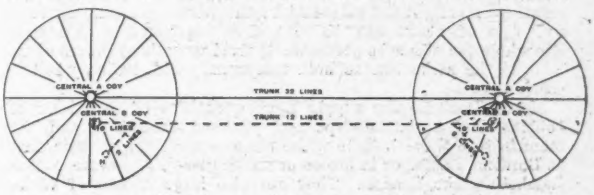
"A naturally feels that his rights are infringed, and claims that B has made a derivation to connect-up H, and so has gone against the leave of the Town Council; and also has infringed the rights of A, and A's contract with the Town Council, which says that A alone will have the right to make derivations inside the municipality.

"B claims that it is not a derivation from his centre or system or trunk, as H's wires run direct to D town without any connection with any other house but J's.

"Do not any wires belonging to a company and rented out, running on their trunk posts and cross arms, form part of their system or trunk? and if these wires branch off from that trunk to enter a house of a subscriber, is that not a derivation from their trunk?

"What other claims do you think that A can put forth to prevent further encroachments? NOTE.—H and J are matrix and branch houses of same firms in the two towns."

*** It is not altogether easy to answer these questions without access to the statutes or ordinances under which the municipality have the right to grant telephone concessions. It appears, however, that the sole right to grant telephone rights in a particular municipality is vested in that municipality, and they apparently



have a right to confer a monopoly. Upon the facts stated, it would appear that B has not a shadow of right to establish more than one office in either town, and the fitting up of an instrument in a subscriber's premises would appear to be a direct violation of this right. If it were permissible for B to give a single connection with the main trunk-line, it is impossible to see why the same privilege should be withheld from X, Y and Z, to the manifest destruction of the monopoly enjoyed by A.

In England, of course, nothing is known of monopolies conferred on individuals for the exercise of telephonic rights in particular towns or districts. The monopoly for the whole country is vested in the Postmaster-General, who for a period of years has transferred his privileges to the National Telephone Co. The Telegraph Act provides that it is lawful for a business firm having two offices to have a private wire between those offices. It would, however, be illegal for that firm to allow other persons living at either end of that wire to hitch on to it and make use of it.

With regard to the remedy of which the A company can avail itself, this can only be found by an examination of the local laws. It would be necessary to see the document by which a telephone monopoly was granted in order to ascertain whether the authority granting it undertook to take steps to secure that it should not be violated.

It is difficult to see how the A company can of itself take proceedings against the B company. To take a suggestion from the laws of America, it may be mentioned that, according to the Act of Congress, Sec. 5,263, telegraphic monopolies are illegal in any of the States of the Union. Apparently the monopoly to which our correspondent refers does not contravene the laws of the place from which he writes.

"AGNOLA" writes:—"With further reference to mine of the 24th ult., I should be obliged if you would let me know whether it is legal for the solicitor to a gas company to act as Town Clerk when the question of public lighting is being discussed. There is a regular row on about the street lighting question, and the public are most dissatisfied with the gas lamps erected."

*** A town clerk, who is appointed by virtue of the Municipal Corporations Act, 1882 (Sec. 16) is not entitled to any payment in addition to his salary for duties imposed on him by statute, in the absence of a special provision to that effect (Jones *v.* Mayor of Carmarthen (1841), 8 M. and W.). But, if duly qualified, he may be appointed professional adviser to the council, and receive for his services such remuneration, beyond that paid him as clerk, as may be agreed on. He is entitled to "all proper and reasonable fees and charges" for his work under the Parliamentary Registration Act, 1843. So far as can be ascertained, a town clerk is not ordinarily entitled to take private practice. It will probably be found, on further inquiry, that it is the firm of which the town clerk was at one time a member that is acting for the gas company.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Doulton Insulators.

The carrying and supporting of cables on walls and in subways of all descriptions cannot be effected by a more satisfactory method than by the adoption of the cable-racks manufactured by Messrs. Doulton & Co., of Lambeth Pottery, S.E. These are illustrated below (fig. 1), and consist of cream-glazed vitreous stoneware, mounted upon cast-iron bases, and held firmly in position by means of studs screwed into the base and with nuts and washers. The racks are made in two sizes—No. 1 for large and heavy cables from 1 in. up to 3 in. diameter, and No. 2 for lighter cables from ½ in. diameter upwards. The outside dimensions of the cleats in each series are the same, and therefore the cleats are interchangeable; but the

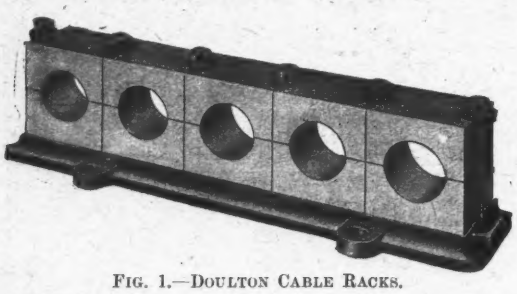


Fig. 1.—Doulton Cable Racks.

cable "ways" are varied in size to suit the diameters of the cables Doulton's rack-insulators have been supplied in quantities; the metal-work is light but substantial; the parts are readily renewed, and sizes of cleats can be altered as requirements necessitate. The whole can either be permanently fixed to walls by means of rag bolts, or the racks can be held temporarily with ordinary bolts or coach screws.

Messrs. Doulton also supply large quantities of shackles, reels, bobbins, bushes, button-type and petticoat insulators, and they manufacture these both in white vitreous porcelain, at their works at Burslem, Staffs., or in brown or cream glazed stoneware, at their Lambeth works, London. They are also large makers of various types of high-tension insulators for overhead transmission work, and their insulators have been tested to upwards of 100,000 volts.

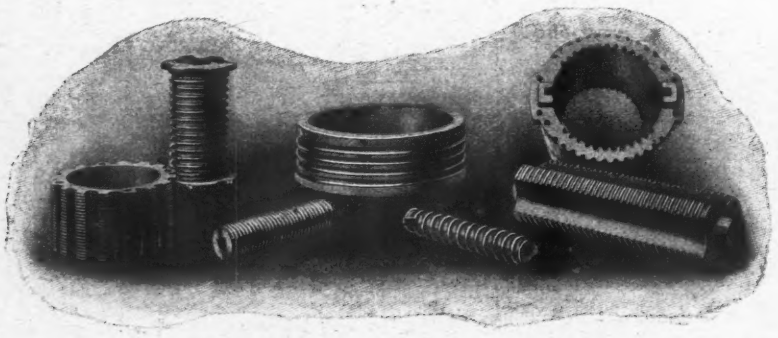


Fig. 2.—Various Patterns of Doulton Insulators.

For underground work, a satisfactory method of affording protection to cables is by using the Doulton stoneware troughing and covers with vitrified glazed stoneware bridge-insulators. This material is of the highest quality, with high insulating properties, and the advantages of the use of stoneware throughout for insulation purposes are obvious. The lengths of the troughing being short, permit of changes of direction being made, either horizontally or vertically, though bends are made if desired. Slight subsidence of the ground does not impair the joints, which are made up by the bitumen filling the ample sockets provided. The troughs and bridges are made in a variety of sizes suitable for carrying a single cable or to carry several cables in the same trough.

Messrs. Doulton are also patentees and manufacturers of the leading types of third-rail insulators, and they have supplied the insulators in bulk for all the railway lines now electrified on this system in this country.

"Onewatt" Lamps.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, N.E., have made a further advance in the production of their "Onewatt" lamps of drawn tungsten wire. These are now available for 20 to 30 volts, 10 and 16 c.p., in bell-shaped (fig. 3) and spherical bulbs. These, therefore, can be used in installations where transformers are used at 25 volts, as they are, of course, equally suitable for d.c. and a.c. circuits. They are also of the voltage employed in train lighting. The gap between the miniature and the 100-c.p. lamps of drawn tungsten wire, already described, is thus being filled up. Particulars of the new patterns are given in list 4A5, just issued,

BUSINESS NOTES.

Bankruptcy Proceedings.—Harry Graham, plumber and electrician, Huddersfield.—July 29th is the last date for the receipt of dividend. Trustees, Messrs. E. Netherwood and G. W Smith, of 1, Cloth Hall Street, and 23, John William Street Huddersfield, respectively.

R. E. Joy (Bristol Electrical Co.), electrical engineer, Cheltenham Road, Bristol.—A first and final dividend of 1s. 9¾d. in the £ is payable July 25th at the Official Receiver's Offices, 26, Baldwin Street, Bristol.

Albert Clapham (trading in co-partnership with John William Hunter, as the Yorkshire Motor-Car and Electrical Enginering Co.), electrical engineer and motor-car dealer, 101, Kirkstall Road, Leeds.—This debtor applied to his Honour Judge Graham, K.C., sitting at the County Court House, Albion Place, Leeds, last week, for his discharge from bankruptcy. The Official Receiver reported that the receiving order was made on August 15th, 1904, on a creditor's petition. The proofs lodged amounted to £4,220, and the assets had realised £600 15s. No dividend was paid, the assets having been paid out mainly for law costs after petition, caused by Hunter having gone away, and proceedings under disclaimer of lease, investigation and report to Court on application for order to prosecute Hunter. The Official Receiver stated that he had no reason to believe that Clapham had committed any act which would justify the Court in refusing, suspending, or qualifying an order for his discharge beyond the usual short period. His conduct during the proceedings had been satisfactory. The discharge was granted subject to a suspension of two years.

Charlotte Rix (Bridgewater & Wright), electrical engineer, 78, York Road, King's Cross, London.—July 29th is the last day for the receipt of proofs for dividend by the trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

D.P. Batteries.—We are informed that with the present low prices ruling, owing to the depreciated market values of lead, the public are doing exceedingly well in placing their orders for storage batteries. Contractors might take a note of this point in their canvassing books. The D.P. Battery Co., Ltd., of Bakewell, have lately obtained many contracts, the orders upon which their works have lately been, or are now, busily engaged, including a second large battery now being installed at Letchworth

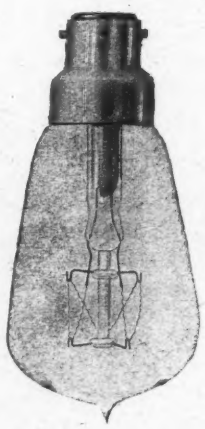


Fig. 3.—"Onewatt" Lamp.

for the First Garden City, Ltd.; three light and power batteries recently supplied to the Midland Railway Co., the Melbourne Electric Light and Power Co., and the Blackpool Co-operative Society. In foreign trade they are just shipping five batteries for India, China, New Zealand, and the Argentine, and have been able to ship to the United States, in spite of the tariff.

Installation Contracts.—Among orders received during the last few days by Messrs. Baughan & Co., of Reading, are the following:—Duplication generating plant at the Reading Co-operative Society; suction gas engine and complete plant at Henley-on-Thames; complete private plant near Newbury; complete installation for 300 lamps and of intercommunication telephones at Schiff Home of Recovery, Cobham; lighting extension at the University College, Reading; complete private plant in Devonshire; power extension at Messrs. H. and G. Simonds's Brewery, Reading, together with several power and heating contracts.

Electrical Installations for New Cunarders and other Vessels.—Messrs. W. C. Martin & Co., electrical engineers, Glasgow, have received orders from Messrs. Swan, Hunter and Wigham Richardson, Ltd., to supply and fit electrical installations for the two new steamers building for the Cunard Co. The installations will have a large number of lights and motors, and will be fitted similar to the equipment supplied by the same firm for the *Mauretania*. Messrs. Martin & Co. have also contracted to supply the electric installation for the new Anchor liner *Cameronia*, and several of the new steamers recently ordered for the British India Steam Navigation Co., two steamers for the Harrison line of Liverpool, a large passenger liner for Italian owners and other vessels, making a total of electrical plant in hand of over 2,000 h.p.

Church Installations.—It has been decided to illuminate St. John's Church, Cloughfold, Rawtenstall, with electric light, and the contract has been let to MESSRS. WHIPP & BOURNE. MESSRS. J. HAWORTH & CO., electrical engineers, of Rawtenstall, have obtained an order for an electric organ-blowing installation for the Newchurch Wesleyan Chapel.

For Sale.—MESSRS. FULLER, HORSEY, SONS & CASSELL will sell by auction on August 9th and 10th, at Milbank Station, Westminster, a quantity of electrical generating plant. The Corporation of Dewsbury invites offers for one steam engine with two dynamos coupled to it. The Sanitary Commissioners of Gibraltar have for disposal surplus electrical plant. MESSRS. J. GLOVER & CO., Newcastle, have for disposal the stock of T. Noakes and Sons, Ltd. (in liquidation), consisting of steam and boiler fittings. See our advertisement pages in this issue.

Osram Lamp Caps.—We have on several occasions given particulars in regard to the extraordinary length of time that certain Osram lamps have been in use for street lighting in various parts of the country; in some cases it has happened that the metal caps have been eaten away through prolonged exposure to the elements before the filaments failed. We now learn from the manufacturers that, on this account, they have decided in future to supply high candle-power Osram lamps with practically indestructible plated copper caps instead of brass as heretofore.

Exhibition Awards.—We understand that, at the St. Petersburg Exhibition of Internal Combustion Engines held under the auspices of the Russian Imperial Technical Society, to which we referred fully in our last issue, MESSRS. CHAS. PRICE & SON, of Broadheath, near Manchester, were awarded a silver medal for the engine shown by them.

MESSRS. HANS RENOLD, LTD., have been awarded a gold medal for their exhibit of steel driving chains at the Japan-British Exhibition.

Book Notices.—*Leeds Chamber of Commerce Year Book.* 1910. London: Bemrose & Sons, Ltd. First issue.—This is a book of close upon 300 pages which is intended to serve both as a record of the trade facilities of the City of Leeds, and as a compendium of commercial intelligence for the assistance of members of the Chamber who are doing business with other countries. It has been compiled and edited with the authority of the Chamber by the secretary, Mr. Rhodes K. Calvert. As the publishers say in issuing the volume it is intended to supply traders in all parts of the world with brief particulars of the manifold industrial resources of the City of Leeds, and to supply the members of the Chamber, in a brief and compendious form, with information as to the regulations of Foreign and Colonial Governments in relation to British merchants doing business in their territories. The latter purpose is served by summaries of Consular information containing essential details requisite to traders doing business abroad. The ramifications of Leeds industries are so extensive, and the staple trades of the city and their subsidiary industries so numerous, that an enumeration of them, together with a short account of the facilities afforded by Leeds in each of its branches of commercial activity, should prove of great advantage to the Foreign and Colonial trader. Each industry, with its complex organisation and subordinate branches, is described by competent authorities. Engineering industries and the facilities for obtaining electric power supply are fully covered. More than one-half of the book consists of a trade index of the members of the Chamber and numerous advertisements by Leeds firms. We gather that a very large circulation of the book has been made among English foreign and Colonial Chambers of Commerce, Canadian Boards of Trades, British Consuls and Consular agents, British ambassadors, between 5,000 and 6,000 others going to merchants in home and foreign markets, clubs and so forth.

"*Journal* of the Institution of Electrical Engineers." The issue for June, 1910, contains the following papers:—"Losses off Transmission Lines due to Brush Discharge," by E. A. Watson; "Modern Electric Time Service," by F. Hope-Jones; "Balancers for Three-wire Systems," by A. G. Cooper; "Standardisation of Electrical Machines," by R. Orsettich; "Physical Properties of Switch and Transformer Oils," by W. P. Digby and D. B. Mellis; "Rating and Testing of Motors for Intermittent Working," by Dr. R. Pohl; "Graphical Treatment of the Zigzag and Slot Leakage in Induction Motors," by R. E. Hellmund; "Experimental Electrical Circuits for Laboratories," by W. P. Steinthal.

"Practical Electro-Plating." By Geo. Gentry. London: Percival Marshall & Co. 1910. Price 1s. net.

"*Journal* of the Franklin Institute." Vol. CLXX, No. 1. July, 1910. Philadelphia: The Institute. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." Vol. 32, No. 7. Baltimore, Md.: The *Journal* Offices. Price $1.00.

"*Proceedings* of the Engineering Association of New South Wales." Vol. XXIV. 1908-9. Sydney: 5, Elizabeth Street.

Bulletin of the Société Belge d'Electriciens." June, 1910. Brussels: Ramlot Frères.

"The College Quarterly." No. 3. May, 1910. Melbourne: The Working Men's College. Price 6d. net.

"Brazil: Its Natural Riches and Industries." Vol. I. Paris: Aillaud & Cie. 1910.

Catalogues and Lists.—THE SKEFKO BALL BEARING CO., LTD., Carlton House, Lower Regent Street, S.W.—24-page catalogue containing a full description, with illustrations, diagrams and a great deal of tabular matter, of the "Skefko" (S.K.F.) ball bearings which they are introducing into the English market. These bearings, we understand, are the invention of a Swedish engineer, Mr. Sven Wingquist, and they have had a good reception on the Continent.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—Three new lists: No. 5009B which deals with the "Excello" flame lamps, supersedes No. 5009A, a better and more concise arrangement of the information having been aimed at. Among the features calling for reference are patterns USG and USW, which are fitted with a device for automatically cutting out the lamp should it for any reason go out. Some new reflectors and covers are illustrated. In list 6020, Section 5, dealing with three-phase motor starters, there are some new designs, including pattern "D D" star-mesh switches for starting motors with short circuited rotors. The third list (No. 1,409) gives half-tone and line views of the "Kino" cinematograph lamp with a special design of carbon arrangement which enables it to give a great light with 30 amperes.

MESSRS. SIEMENS BROTHERS & CO., LTD., Caxton House, Westminster, S.W.—Three new publications relating to the firm's electro-medical manufactures have just been issued. Pamphlet No. A 506, "Electro-Medical Apparatus," which has been produced for the forthcoming British Medical Association annual exhibition, in London, contains up-to-date illustrated abstracts of many of the Siemens electro-medical apparatus. Supplement No. 8 to catalogue No. 506, "X-ray tubes and accessories," has been issued owing to the great progress and improvements made in connection with these manufactures. Messrs. Siemens draw special attention to the section dealing with tubes for instantaneous radiography as well as the tubes for radiotherapy. In addition, users will find the descriptions of various forms of regenerators and regulators of interest. Catalogue No. 525, "Radium Salts and Applicators. Radio-active Earths," gives for the first time a practical description and prices of the various radium salts and applicators supplied by the Banque du Radium, Paris, for whom Messrs. Siemens Bros. are the sole agents in this country. The last section of the book describes the radio-active (actiniferous) earths and materials, based on the latest researches.

THE C. W. HUNT CO., West New Brighton, New York.—General catalogue No. 102, pocket size, containing 112 pages of small illustrations and particulars of their coal-handling and hoisting machinery.

MR. J. STOTTNER, M.I.E.E., Birkbeck Bank Chambers, Holborn, W.C.—Mr. Stottner, who, as our readers are aware, retired two years ago from the London general managership of the Electrical Co., Ltd., after 16 years successful record, has established business on his own account at the above address, and he has now issued a catalogue of 32 pages, in which are illustrated and briefly particularised the "Alioth" machines, transformers, &c., which he intends bringing under the attention of engineers in this country. It is mentioned that the works output averages per annum 8,000 "Alioth" motors and generators, of a total equivalent of 200,000 H.P., and 2,000 "Alioth" transformers of a total capacity of 90,000 KW. A list of central stations, power transmissions, colliery installations, and electric railways that have been equipped by the firm, is followed by a number of half-tone pictures of some of these works, and illustrations and general information concerning two and three-phase motors, single and three-phase air-cooled transformers, oil transformers, and high-tension oil switches.

THE ELECTRICAL APPARATUS CO., LTD., Milford House, Queen's Road, Battersea, S.W.—Leaflet M4 giving prices, brief particulars and illustrations of their combined meter and fuseboards.

MESSRS. VERITYS, LTD., Hardman Street, Deansgate, Manchester.—New list (No. 614) of 24 pages containing many illustrations of, and a great deal of tabular price information relating to, their various starters and regulators. From among the various lines here dealt with we may select for special mention their double arm starters which are an entirely new line, and are claimed to be as near to "fool-proof" as it is possible to construct a starter without many complications; also a complete range of regulators for front and back of board of the "Enamel" type facilitating the renewal of resistances. Three-phase starters are now being made by Messrs. Verity, and they are included in the present list.

MR. G. BRAULIK, 8, Lambeth Hill, Queen Victoria Street, E.C.—Revised illustrated price-list (8 pp.) of white porcelain insulators and china wiring accessories; also one relating to the new 1910 pattern "Eclipse" flame arc lamp. Also new pamphlet, No. 4, containing illustrated particulars and prices of cast-iron watertight fittings for electric lighting in collieries, mills, factories, ships, public thoroughfares, &c., also watertight hand lamps.

MESSRS. T. W. BROADBENT, LTD., Victoria Electrical Works, Huddersfield.—New leaflet (No. 9) giving descriptive particulars of the firm's "M" type motors—continuous-current protected and ventilated. Tabulated sizes, outputs, prices, &c., are given.

MESSRS. DUGDILL'S PATENTS, Failsworth, Manchester.—Pocket price card showing on one side details of prices of their movable and self-sustaining joint fittings, and giving on the reverse side tiny sketches showing the various styles of these fittings.

PHŒNIX DYNAMO MANUFACTURING CO., LTD., Thornbury Works, Bradford.—Pamphlet relating to crane motors, bringing out for the benefit of users, some points relating to the working, design and testing of intermittently-running machines; also a neat booklet containing an illustrated account of the "Phœnix" electric bench-grinding machine.

MESSRS KATER & ANKERSMIT, 14 and 15, Conduit Street, London, W.—Four-page list containing an illustrated description of their "Universal" patent oil separators, oil and water pumps, and combined oil collector and distillator.

E

COWPER-COLES GALVANISING SYNDICATE, LTD., 82, Victoria Street, S.W.—Circular describing, with half-tone views, the regenerative galvanising process, and stating its advantages.

ECLIPSE ELECTRIC CO., 77, St. John's Road, Bootle.—Leaflet fully describing, and giving an illustration of, the "Whipple" electric tire pump; also a leaflet stating brief particulars and prices of the "Coy" small gas and oil engines, and combined electric sets.

THE VICTORIA ELECTRICAL WORKS, 7, Broken Wharf, Upper Thames Street, E.C.—New illustrated catalogue of over 70 pages, which is being issued to the wholesale trade only, setting out in the first section brief information, together with illustrations and prices, of a great variety of electric bells and bell material, including such things as pushes, fire alarms, contacts, switches, watertight mining pulls, motor-car plugs and switches, &c.; in the second section a variety of electric lighting accessories is similarly treated, included among them being Addison's patent automatic transformer switch.

Circuit-Breakers v. Fuses.—*Apropos* of the letter by "Y. Z." in our last issue calling attention to drawbacks in connection with the use of fuses for house and lighting circuits, the ADAMS MANUFACTURING CO., LTD., write that his remarks apply with greater force to motor-control panels.

For all drives where heavy overloads are likely to occur, they invariably recommend automatic circuit-breakers, fitted with overload release, in place of fuses. The combination of a starter with such a breaker, either S.P. or D.P., gives a panel ready for all emergencies. One of these panels installed at a saw for cutting wet logs has opened the circuit as many as 20 and 30 times a day on what were practically short-circuits, without any damage either to the starter or breaker.

It is possible, by a patented method of the firm's, to interlock the breaker and starter in such a manner as to produce practically sparkless operation, and the life of the whole electrical plant, and of the tool it drives, is considerably prolonged.

Holidays.—MESSRS. E. BROOK, LTD., of Huddersfield, announce that their works and offices will be closed from Friday, July 29th, until the morning of Monday, August 8th.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., of Cheston Road Aston, announce the closing of their works and offices from July 29th until August 8th for the August Bank Holiday and annual holidays.

THE ADAMS MANUFACTURING CO., LTD., of Bedford, announce that their works will be closed from Saturday, July 30th, until the morning of Monday, August 8th, for the annual holidays.

MESSRS. MAWDSLEY'S, LTD., of Zone Works, Dursley, Glos., announce that their works will be closed from Friday, 29th inst., till Monday, August 8th, for the holidays.

THE CRYPTO ELECTRICAL CO. announce that their premises will be closed from Saturday, July 30th, until Monday, August 8th, for the annual holidays. A small staff will deal with urgent correspondence.

THE BRITISH PROMETHEUS CO., LTD., Salop Street Works, Birmingham, announce that their works and offices will be closed from Wednesday, July 27th, until August 8th, for stocktaking and the annual holidays.

Annual Outings.—The staff of the GUILDFORD ELECTRICITY SUPPLY CO., LTD., held their annual outing on Monday, July 4th, when an enjoyable trip was made to Dover and Folkestone. The party left Guildford by an early morning train, and on arrival at Dover, breakfast was served at the Esplanade Hotel. The remainder of the morning was spent in sight-seeing. Luncheon was partaken of at the Lord Warden Hotel, the staff being joined by several guests. In the afternoon the party went to Folkestone, where the rest of the day was spent. The weather was ideal.

Aberdeen Corporation Tramway employés held a picnic last week within the policies of Pitmedden House. The company numbered 350.

Liquidation.—PREMIER BOILER TUBES, LTD.—A meeting is to be held at 1, Southampton Street, Bloomsbury, W.C., on August 15th to hear an account of the winding up from the liquidator, Mr. H. Maconochie.

Watkin Switch.—For the convenience of contractors who may wish to demonstrate the Watkin switch to their customers, the ADAMS WATKIN CO., LTD., 36, Victoria Street, S.W., have fitted up a dining room, charmingly furnished, with the table laid, two switches controlling the hanging and table lamps. This is in addition to their ordinary demonstration rooms, where the switch is shown in a more commercial manner, on boards fitted with banks of lamps, with volt and amperemeters or wattmeter in circuit, so as to show the saving which it is claimed is effected by the use of this regulating switch.

Trade Announcements.—MESSRS. A. HIRST & SON, LTD., sole makers of the Crescent coal cutters and coal drills, have now settled down in their newly-erected and commodious works in Meadow Lane, Dewsbury. The premises are so constructed to allow of considerable expansion when necessary. A number of up-to-date machine tools have been or are being installed in the shops, and the number of hands considerably increased. The change has been made on account of the demand for the firm's specialities; many orders are in hand for the Crescent coal cutter.

The trade are asked to take note that the telegraphic address of THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., has been altered to "Eoa, Birmingham."

MESSRS. TETLEY & CO., of Salford, have appointed Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, E.C., as sole agents for London and South of England for all their manufactures.

Owing to increased business, MESSRS. HOGAN & WARDROP have removed from Charing Cross Road, to larger premises, their address from to-day being 2, Gresham Buildings, Basinghall Steet, E.C. (Telephone No. "London Wall 723.") They will now carry larger stocks of their EMI fans and small motors; a full range of the various switchgear manufactured by the Midland Electric Manufacturing Co.; also, as representatives of Cryselco, Ltd., they will hold stocks of metallic and carbon filament lamps, and stocks of the manufactures of the Electrical Conduit and Fittings Co., of Walsall, with whom they have entered into a close connection.

LIGHTING and POWER NOTES.

Ashton.—A sum of £48,424 is to be spent upon extensions to the Corporation electricity works.

Brazil.—At a recent meeting of the Société Internationale des Electriciens, held in Paris, an interesting paper was read by M. Mongin on "The Electrical Installations in Rio de Janeiro." The authorities of the city—which has a population of about two millions—granted the concession for the electrical services—lighting, power, tramways and telephones—about five years ago to the Rio de Janeiro Tramways, Light and Power Co. All the services, with the exception of the telephone, are supplied from a single central generating station, of a capacity of 40,000 H.P. The plant, which has been described in the REVIEW, is situated about 50 miles from the city, and supplies three-phase current at 88,000 volts pressure, which is transformed on the outskirts of the city to 23,000 volts for the outlying mains and to 6,300 volts for the city mains, and finally to 100 volts for the lamp circuits. Another portion of the H.T. supply is transformed to 600 volts continuous current for the tramways and arc lamps.

Bury St. Edmunds.—The T.C. has decided, by 6 votes to 5, not to reduce the price of current for private lighting from 6d. to 5d. per unit, as it would entail a loss of £400 per annum.

A loan of £330 for an additional feeder has been applied for.

Carlisle.—At the T.C. on the 13th inst., a discussion took place as to the appropriation of the electricity profits, and it was agreed to allocate £1,000 for the city fund, and the same amount to the reserve fund, carrying forward the remainder as a working balance.

Dundee.—At a recent meeting of the Electricity Committee a letter was read from the Hon. Secretary of the I.M.E.A. intimating that at its annual meeting the provisions of the Electric Lighting Act, 1909, were considered, and it was deemed desirable that steps should be taken to secure the passing of another Act giving power to local authorities to supply, &c., fittings and wire consumers' premises, and also deal with the question of "stand-by" supply, and the further protection to authorised undertakers from the operations of unauthorised undertakers within their area. The Committee's opinion was invited as to whether such a Bill should be promoted. A member complained that this was competition with private trade, and that they were going too far in this direction. The town clerk pointed out that it was done in the gas department.

Mr. H. Richardson, the engineer, said the gas undertakings throughout the country had almost unlimited powers whether they used them or not. Some places, like Glasgow, had the electrical powers desiderated, and although they had not seen fit to use them they were well aware of their moral effect. Personally, he was against competing with local contractors, but it must, nevertheless, be borne in mind that local contractors nowadays were of very little help to the electricity department either in Dundee or any other city. They pick and choose their work, Mr. Richardson continued, and Corporations had to do all the canvassing nowadays. There were many things the Corporation could do which the contractors never would touch. A member interposed that he did not understand Mr. Richardson's statement that the contractors did not help the electricity department. He imagined that every order secured by a contractor meant a new customer to the department either for lighting or power. Mr. Richardson, in reply, said when he first heard that argument about two years ago, he thought there was a great deal in it. A little while ago the electricity department eased off its canvassing, and down went its business at once. They found that well over 90 per cent. of the extra business obtained in Dundee, even although contractors supplied it, was canvassed for by the department's men, and the specifications were actually prepared by the department. The work was pushed along by the department. They could easily get the contractors to go round the better quarters of the city, but they would not go where jobs were small, and sometimes with very little profit in them. That was left to the department. He was quite agreeable that such work should be done through the contractors, so long as they gave him the power to have it done thus. He did not want to set up a department of their own. The Committee agreed to support the association's proposal.

Freshwater.—With reference to the proposal of the P.C. that electricity for public lighting should be generated by the machinery at the sewerage works of the Isle of Wight R.D.C., referred to in a recent issue of the ELECTRICAL REVIEW, the Rural Council has replied that to carry out the project urban powers would have to be secured; the consent of the L.G.B. would have to be obtained to utilise the engines for the purpose; a prov. order for E.L. would have to be procured; and arrangements would have to be made with the gas company so as to avoid its opposition. It was added that the R.D.C. did not see its way to go further in the matter. Thus, the excellent and interesting project has fallen to the ground, although the P.C. is strongly in favour of it.

Haslingden.—At a meeting of the Haslingden Trades Council on Thursday, the following resolution was unanimously adopted: "That the Haslingden Trades Council representing the affiliated societies, comprising 4,000 members, deem it expedient both in the interests of the ratepayers and the town generally, that the proposed work of generating our own electricity, both for light and power purposes, should be commenced at once." It was agreed that electricity was making great headway as an illuminant.

Hereford.—As an outcome of the recent L.G.B. inquiry, the T.C. has decided to pay an overdraft on capital account of £425 out of the borough fund, and to increase the loan of £1,500 for mains extensions to £2,000.

Heston and Isleworth.—Major J. Stewart, R.E., held a long inquiry on Tuesday into the U.D.C.'s application for a £3,048 loan for extension of buildings, plant and machinery. Mr. H. J. Baker, the clerk, said the plant was running at its utmost capacity, and if one engine broke down part of the district would go into darkness. The provision of new plant would obviate that, and meet extensions for three years to come. The units generated had risen from 469,000 in 1907 to 605,000 in 1909; in the same period the consumers had extended from 521 to 646. The Inspector said that the concern seemed to be in a satisfactory condition now that the U.D.C. was complying with the obligations laid down by the L.G.B., that it must get rid of its deficiency within three years from 1909.

Japan.—According to the last Japanese mail, the Tokio Electric Light Co. is menaced with a serious boycott, a large number of restaurant owners complaining that the company has given more favourable terms to a number of its customers. So greatly is the grievance felt that it is stated that the owners of no fewer than 900 establishments have banded together, and have made arrangements with the Tokio Gas Co. to supply them with light at greatly reduced rates.

Kirkcaldy.—The electric lighting undertaking has been a profitable concern during the past year. The net profit has been £700, and on the tramways there is a surplus of £44. The annual report of the tramways shows that fully 4,500,000 passengers had used the cars. Once the system is linked up with Dysart and also with the West of Fife route, greater developments are expected.

Leicester.—Mr. J. Swinburne, F.R.S., has been appointed to advise the Corporation Electricity department as to the advisability or otherwise of combining under one management the electricity department at the Ayleston Road works and the power station near Belgrave.

Llanelly.—A B. of T. inquiry was held last week to hear objections that had been made by owners of houses within 200 yards of the generating station about to be erected by the Llanelly and District Electric Light and Traction Co. As a result of the inquiry all objections were removed, and Mr. George Mercer, the contractor, immediately commenced work on the proposed building, which, it is hoped, will be completed before the end of the year.

London.—BERMONDSEY.—The accounts of the electricity undertaking for the year ended March 31st last show a total expenditure on revenue account of £10,947, while the income amounted to £21,743. After deducting interest and instalments on loans there remains a net profit of £43. There had been a reduction in the cost of generation, the works costs having been reduced from 0·6d. to 0·52d. per unit. The units sold during the 12 months totalled 3,183,691, an increase of 402,108 units. The connections for the year were equivalent to 644 KW. The Finance Committee, commenting upon the report, said that they wished to draw serious attention to the fact that on the year's working, with an outstanding loan indebtedness of £152,973, the very small surplus of £43 is shown. In the Finance Committee's opinion that result is partly due to the very low price at which energy is now being sold, and they think the Council should be very careful as to how the undertaking is managed in the future, more especially in regard to the incurring of further liability by way of loans.

HAMPSTEAD.—An exhibition of heating and other electrical appliances is to be held in the Baths, Finchley Road, from October 4th to 8th, inclusive. The Lighting Committee have been authorised to convert 802 more gas lamps to incandescent electric lamps in addition to those already in hand.

MARYLEBONE.—The annual accounts of this undertaking show that the year's working has resulted in a credit balance of £8,482, instead of an estimated balance of £1,341. The previous year's working showed a deficit of £3,930. During the year 10,776,459 units were sold, as against 9,000,000 in the previous year, or an increase of nearly 20 per cent.; the average yield per unit was 3·8d., as against 4·13d. in 1908-9. The gross income from all sources amounted to £174,542; working expenses were £52,873, leaving a gross balance of £121,669, from which financial charges were deducted, leaving the balance mentioned. Generation costs per unit amounted to ·498d.; distribution costs, ·139; management, ·199d.; and rent, rates and sundries, ·125d.; making a total of ·961d. per unit sold, as against 1·19d. in 1908-9. There were connected to the mains at March 31st last a total of 19,084 KW. of plant, comprising 14,737 KW. of private lighting, 2,117 KW. of motors, 1,972 KW. of heating and miscellaneous plant, and 258 KW. of public lamps—these figures representing an increase of 1,191 KW. during the year. Included under "heating," are 970 radiators, 105 cooking appliances, 160 irons, 427 medical appliances, &c. The public lighting comprises 80 arc lamps and 2,179 columns fitted with two or three incandescent lamps each; the conversion of public street lamps is being continued, and a further 1,100 lamps are now being dealt with. The revenue of the Sales Department amounted to £6,666, showing a deficit of £1,185 on the initial year's work; some 15 outdoor representatives are now employed, and certain exceptional expenditure was incurred. Of the net balance, £2,112 is utilised for writing off special expenditure, and the balance, with previous amounts, leaves a surplus of £24,981. It is pointed out that the average price charged (3·66d. per unit) includes 1·42d. of loan charges in respect of the purchase price of the undertaking; the load factor on the station, although comparatively low, is steadily improving, and reached 15·7 per cent. last year; the capacity of the station plant remained at 12,000 KW., and the maximum load was 7,824 KW. The satisfactory result of the year's working reflects great credit on the engineer and his staff, and amply justifies the energetic business-getting policy which constitutes such an outstanding feature of the Marylebone undertaking.

Luton.—It was reported at the meeting of the New Industries Committee on Friday that owing to the low price of electricity in the borough a firm had been induced to establish a new industry in the town. The nature of the proposed new works has not yet been made public.

Mansfield.—The municipal electricity undertaking shows a gross profit of £4,046 for the past year. The net profit is £136, of which £100 will go towards the rates. The constant increase in the use of the metallic-filament lamps, together with a very large decrease in the amount of energy taken by the tramways, has adversely affected the revenue of the undertaking, but it is hoped that the worst effect of the former influence has now been experienced, and that the latter will improve with increase of trade and extensions of the lines to other districts. The decrease in revenue from the tramways amounts to over £400.

Middlesbrough.—The T.C. has decided to allow the Cleveland Durham County Electric Power Co. to carry its cables over the transporter bridge on payment of £500 a year.

Newport (Mon.).—The B.G. has entered into an agreement with the T.C. for a supply of electricity for the workhouse boardroom and offices, at 3½d. per unit, for a minimum of 10,000 units per annum.

Radcliffe.—The U.D.C. has adopted the following revised scale of charges for energy:—Lighting, less than 500 units per quarter, 3½d. per unit; 500 units and over, 3d.; places of worship, 3d.; subject to a minimum charge of £1 per annum, with a discount of 2½ per cent. for prompt payment. Power: from 1½d. per unit for up to 100 units per H.P. per quarter, to ·8d. per unit for over 25,000 units. Heating: flat rate of 1½d. per unit.

Rosyth.—The contractors at the Naval Base, notwithstanding the delay caused by the destruction of the electric power station, are making considerable progress with the work. A new power station, partly built of brick, has been erected, and the second of the new engines is now in working order.

Russia.—A commission has recently been appointed by the Russian Ministry of Water Ways and Communications to inquire into the subject of the available water power in the country which can be utilised in the generation of electrical energy for lighting and power purposes.

Salisbury.—The E.L. Co. has decided to apply to the B. of T. for powers to extend the area of supply to the limits of the borough boundary.

South Africa.—For the last year the Cape Town Electricity Department produced a revenue of £56,097, or a gross profit of £24,077, a decrease of £1,122 as compared with the previous year. Private consumers took 76,000 fewer units, but power consumers added 45,400 units during the year. There was a decrease of 71,000 units for street lighting in Cape Town, but the Woodstock supply shows an all-round increase; the railway and harbour contract also accounts for an additional 600,000 units during the year.

Southampton.—At the last meeting of the T.C. a letter was read from the L.G.B. in reply to an application for sanction to borrow £805 for substituting electric light for gas in certain of the Council's schools. The Board suggested that the work be deferred until the debt on the existing system of lighting had been materially reduced. The borough engineer and surveyor said that this would mean a postponement for a very considerable period, and it was therefore resolved that the schools be equipped with electric light, to be paid for out of the current estimate.

Southend-on-Sea.—The Education Committee has decided to install electric light at the London Road Schools and the special instruction centre (but not to undertake the sale of fittings or lamps or the wiring of houses), on the distinct understanding that the Council is not to be liable for the price of the

goods sold. The postponement is due to opposition on the part of the electrical traders of the city, who contend that it will interfere with their business.

Southport.—The annual report of the electrical engineer (Mr. Black) on the 16th year's working of the electricity department shows that during the year the number of consumers has been increased by 144. The units sold to private consumers were 1,294,446, decrease 108,735. The units sold to the Corporation tramways increased by 8,495, and to the Southport Tramways Co. by 13,441. In November the first serious accident in connection with the undertaking occurred. While the 1,000-H.P. Belliss engine was at work the I.P. guide heated, owing to an insufficient supply of oil. The heating of the guide caused a quantity of inflammable gas to be generated, which could not escape from the engine casing. Before the engine could be stopped the guide seized and ignited the gas, resulting in a severe explosion, which forced a large quantity of oil out of the crank chamber on to two drivers, one of whom succumbed to his injuries. Steps were immediately taken to ventilate the casings of all the engines of this type. There has been a net profit on the year's working of £1,475. From a revenue of £23,950 there has been a gross profit of £13,730, equal to 7·17 per cent., against 7·57 last year. Interest and sinking fund absorbed £12,255. The average price obtained from private consumers dropped from 3·48d. to 3·44d., and from the tramways 1·60d.

South Shields.—Mr. J. H. Cawthra, borough electrical engineer, has just issued his annual report for the year ended March 31st last. In it he expresses his regret that the financial result for the year shows a small adverse balance, yet after taking into full consideration the conditions under which the department has been working, he was convinced that the results might be claimed to be of a satisfactory nature and the Committee were to be congratulated that the deficit was not much greater. Although the number of lighting consumers had considerably increased since the introduction of the new metal-filament lamp, the revenue from private lighting sources was below what it was when the carbon-filament lamp was the only one on the market. The revenue from private lighting for the past year was £12,412, a net decrease of £1,948, as compared with the year ended March 31st, 1908. Another source affecting the revenue during the past year was a diminished traction output, the decrease amounting to £845 on the Corporation tramways accounts, and £51 on the Jarrow Electric Traction Co.'s accounts. The revenue from power consumers had, however, increased by £1,083 as compared with the previous year. The revenue amounted to £25,071, a decrease of £488 and the expenditure to £13,430, an increase of £426. The gross profit was £11,641, against £12,555 in the previous year. After meeting all charges for interest and sinking fund, there was a deficit of £106, which, with a deficit on the quay of £103, made a total deficit of £209, as compared with a surplus of £1,209 in the previous year. The balance in the reserve fund was £9,800 which was equal to 5·8 per cent. on the capital expenditure of plant of a depreciable nature. Mr. Cawthra concludes by stating that the undertaking is in a financially sound condition.

Stretford.—On the 13th inst. a L.G.B. inquiry was held into the application of the Council to borrow £2,150 for the provision of additional plant at the electricity generating station. The clerk said the Council proposed to purchase a Lancashire boiler for £1,200, and a three-wire booster at £950. The Inspector said last year seemed to have been a very satisfactory one, a profit of nearly ½d. per unit having been obtained, as was explained, by economies and decreased cost of output. It was stated that the present system of main road lighting by electricity had been so economical and satisfactory that there would eventually be an extension of the system into the side streets.

Sutton-in-Ashfield.—The B. of T. has revoked the 1904 electric lighting order.

Swaythling.—It was recently proposed at a parish meeting to light by electricity the main road from the Brook Hotel to the Grange, half the cost of which Lord Swaythling offered to defray; this offer was accepted on condition that the remainder of the money could be raised by public subscription. Notwithstanding that the balance of the cost has been collected accordingly, at a further meeting last week a proposition to empower the Parish Council to proceed with the scheme was rejected. There is, however, every probability that, with the money in hand, the lighting of the village will be carried out before the winter months.

Wakefield.—At the monthly meeting of the City Council a rumour was contradicted that there had been a loss of £2,000 on the electricity works, the actual loss being £800, due to the number of metallic-filament lamps connected.

Whitehaven.—Acting under the recommendation of the L.G.B. inspector, Mr. H. R. Hooper, the T.C. has decided to apply for a loan of £1,775 for superheaters, a 250-KW. generating set, and workshop equipment, in addition to the sum of £5,293 already applied for.

Worcester.—The T.C. has postponed consideration of a recommendation from the electricity department that in order to increase the use of electricity, the Council should allow the department to act as agents for manufacturers in the sale of heating and cooking apparatus and motors, on commission.

Yeovil.—Messrs. J. and W. Purves, of Exeter, have informed the T.C. that they intend to apply to the B. of T. for a prov. order for E.L. This, and a letter from Mr. Percy Campling, of Weymouth, offering to place before the Council an E.L. scheme, have been referred to the Gas and Improvement Committee.

TRAMWAY and RAILWAY NOTES.

Blyth (Northumberland).—At a meeting of the U.D.C. on the 14th inst. a letter was read from Mr. A. E. Whitehorn intimating that the Whitley and Monkseaton Council had appointed three members to meet a similar Committee of the Blyth Council to discuss the proposal for a system of tramways between Blyth and Whitley Bay by way of the coast road. It was suggested that the scheme should be developed under the Light Railway Acts. It was decided to invite Mr. F. Spencer, of Halifax, as a tramway expert, to meet the Committee.

Continental Notes.—GERMANY.—The various local authorities in Rhenish-Westphalia, which have hitherto participated in the expenses incurred in promoting a scheme for the construction of an electric railway to connect together a number of towns and districts, met recently at Essen and resolved to abandon the original plan which had been objected to by the State Railways. In place of a high-speed line worked at 75 miles an hour, a new project is to be put forward with a view to the Government granting a concession for a railway operated at one-half this speed on a special track of its own. The line is to be of the type of the Berlin Elevated and Underground Railway, the service is to be at intervals of 10 minutes, and 31 stations are provided for, the total expenditure being estimated at £5,000,000, which would be raised half in shares and half in bonds. The promoters are of opinion that the new scheme will meet the objections of the State Railway authorities.

SWITZERLAND.—On July 16th the Geneva tramway employés decided on a general strike owing to the dismissal of an employé and other matters, and the tramway service has since been suspended. Attempts are to be made to run cars under police supervision.

NORWAY.—The Municipality of Molde has acquired the rights of the waterfalls in the Molde river with the view of erecting electrical works to transmit power from the falls. The capital expenditure is estimated at 120,000 kr. (£6,667).

The Norwegian Electric and Brown, Boveri Co. has received an order from the Stordö Mines for an electric railway to be built for the transport of ore from the mines. The order includes two single-phase locomotives according to Deri's system, and the line is to be completed in the course of this year. The locomotives are to be built at the works of the company at Sköien.

Ealing.—At the last meeting of the T.C. the surveyor said that the work of welding the joints of the tram rails was proceeding at a satisfactory rate, and he thought that what was being done would tend materially to reduce the noise. He had seen nothing of the same kind done in England before, although he believed it had been carried out in Coventry and in St. Louis, U.S.A. As to the over-hauling and repairs to the cars, Mr. Stanley, the managing director of the company, had promised that the work would proceed as fast as possible.

Edinburgh.—The Corporation Tramway Committee is considering a letter from Messrs. Connell & Campbell, on behalf of a London company, containing proposals for new electric tramways. The scheme takes in Easter Road, Canongate, High Street, George IV Bridge, Fountain Bridge, and on to the corner of Ardmillan Terrace. Another proposed route is by Liberton, Mayfield Road, Kilgraston Road and Meadow Walk.

Fife.—The Lochgelly T.C. has received intimation that the Dunfermline and District Tramways Co. is to start the construction of the branch line from Lumphinnans to Kelty immediately.

Huddersfield.—A trial was given this week of a new car, the invention of Mr. P. Kavanagh, of Liverpool; the improvements relate to the entries and exits; the upper saloon is entirely closed. The entry is at the conductor's end, and the exit at the driver's end. This arrangement is claimed to save time and to avoid confusion. The trial worked well.

Japan.—The Electricity Bureau of the Japanese Department of Communications has just granted a charter to the Tokio Railway Co. empowering it to supply current for lighting purposes in all parts of Tokio traversed by its lines—that is, almost the entire city.

Lancashire Scheme.—A meeting was held at Chorley on the 14th inst. to consider a scheme for the construction of tramways from Preston through Bamber Bridge, Chorley, Adlington to Horwich, in central Lancs., a distance of 14 or 15 miles. Mr. H. M. Sternberg, manager of the Anglo-Continental Industries Co., of London, attended, and explained the scheme. Nothing definite, however, was decided upon.

London.—L.C.C.—Proposals by the Highways Committee for new tramways, in respect of which Parliamentary powers will be sought during the session of 1911, include 22½ miles of line at an estimated cost of £462,470, exclusive of cars, car-sheds, substations, &c. Practically all the routes are proposed for conduit working, the most important being Marble Arch, *vid* Edgware Road to Shoot-up-Hill (£120,800); Chalk Farm to Child's Hill (£123,160); and Marylebone Road to Swiss Cottage (£103,000).

An agreement is to be entered into for reference to arbitration of points arising from alleged interference by the Council's tramways in Norwood Road with the Brighton Railway Co.'s signalling apparatus at Tulse Hill and other stations. The president of the I.E.E. will act as arbitrator.

Macclesfield.—The Railless Electric Traction Co., Ltd., of 56, Moorgate Street, London, has informed the T.C. that it proposes to apply to the B. of T. for a prov. order for the installation of railless traction in the town, and to include a public supply of electricity from the generating station which will supply the power to work the cars.

Otley.—At a recent meeting of the District Council, the proposed extension of the Leeds tramway service from Guiseley to Otley, by means of trackless trolley cars, was discussed. The clerk, referring to an interview with Mr. Hamilton, of the Leeds Corporation Tramways, said that that gentleman estimated the cost of the four miles of trolley construction at £10,000; seven cars would cost £800 each, and a depôt at Otley would cost £14,000. Financial charges on this amount would come to £1,479, and if the bill were opposed, to £1,812 per annum. The matter is to be discussed by the tramway sub-committee.

Salford.—The general manager of the tramways states that the concessions which were made in connection with return tickets and scholars and work-girls' privilege tickets, resulted in a substantial reduction of revenue. Prior to the last four months of the year, the receipts fell £4,500 in comparison with the same period of the previous year. Then the concessions were withdrawn. By the end of March the position was righted again. The gross receipts for the year represented an increase of £200 in the 12 months.

For the year ended March 31st, 1910, the tramways have made a gross profit of £86,256, of which £17,000 will be allocated to the relief of the rates. The number of passengers carried during the year was 45,940,755, as compared with 45,975,584 in the previous year. The total expenditure of electricity in the haulage and lighting of cars was 9,266,285 units, or an average of 1·63 per car per mile.

Scotch Turbo-electric Locomotive.—It is reported that this locomotive, which was constructed by the North-British Locomotor Co., of Glasgow, has recently been satisfactorily tested on the lines of the North-British and Caledonian Railway Co.

Southampton.—The Tramways Committee has received a communication from the B. of T., enclosing an order under Sec. 20 of the Tramways Act, 1870, sanctioning the borrowing of £6.300 for the purchase of freehold premises situated in Above Bar Street, for the purpose of being utilised as offices for the tramways, electrical, and other Corporation departments.

U.S.A.—A mono-rail car, running on a 2-mile route, near a New York holiday resort, was derailed on Saturday week, when carrying 100 passengers. It appears that the hastily-built superstructure carrying the running and power rail, sprung as the car was rounding a curve. About a score of people, including the inventor, who was driving, were injured.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—In a recent issue of the *Review of the River Plate*, particulars are given of the development of the United River Plate Telephone Co., Ltd. The telephone was first introduced in Buenos Ayres in 1881, and in 1895 there were 41 companies at work. In the following year the above-named company was registered, to amalgamate two important concerns, and to-day it has a capital of a million pounds sterling. The conversion of the entire system to central battery working, with underground wires, is approaching completion. There are now some 21,000 subscribers in Buenos Ayres and La Plata, and on May 14th last there were 4,754 calls in an hour; 4,339 new subscribers were connected last year.

The Rosario Municipality proposes to tax the company at the rate of 5 per cent. of its gross receipts, on pain of withdrawal of the permit granted in 1886. The company, it is stated, has no concession in that city.

Assessment of Telephone Cables.—A number of the London Borough Councils have agreed to support the Assessment Committee of the Paddington Borough Council in applying to the Treasury for grants in respect of the telephone mains of the Post Office. It is pointed out that the National Telephone Co. are assessed on the cables in their occupation, and it is thought that as the Post Office is in direct competition with the company, the Treasury should also pay local rates.

Cheaper Cables.—The Council of the Empire Press Union, in its first report, notes the concessions that have been secured in Press rates since the formation of the Union, but considers that further reductions are imperatively necessary. The Marconi trans-Atlantic service offers a rate of 3½d. per word, but only a limited amount of Press work can at present be accepted, and the speed of transmission is slower than that of the cable.

Damage to a Chimney-Stack.—The P.M.G. was sued last week for damage to a chimney-stack in Hackney, alleged by the owners to have been due to the attachment of telegraph wires; the chimney was said to be 6 in. out of plumb, and would have to be rebuilt. The house had been standing for 30 years, but the Judge decided that the damage was due to settlement of the foundations, and found for the P.M.G. This is the first claim ever made for damage in respect of the thousands of telegraphic attachments on London chimneys.

Hamburg Telephone Exchange.—After being in course of construction for several years, the new central telephonic exchange at Hamburg, which has displaced the five exchanges hitherto existing, as well as those at Altona and Wandsbek, has just been brought into operation. It has 35,000 connections, but is organised for a capacity of 80,000, and is, therefore, claimed to be the largest exchange in the world. The exchange is arranged on the central battery system, in conjunction with the so-called new distributor principle, which is claimed to render conversations more distinct, to enable connections to be made more rapidly, and faults and errors to be more quickly ascertained. Under the distributor system all calls reach one place, from which they are distributed among the female officials according as they may be occupied or not at the time. Each call lights a small glow lamp at the distributor place, where lamps also show which girls are available at the moment for dealing with the calls, and in this way the work is more evenly divided among them. The subscribers are formed into groups of 10,000, and advantage has been taken of the inauguration of the new exchange to convert the whole of the subscribers' lines to the twin-wire system.

Norway.—The Murray telegraph type-writing apparatus has been introduced experimentally on the line between Christiania and Bergen.

Trans-Atlantic Communication.—Mr. T. N. Vail, president of the American Telephone and Telegraph Co., recently visited this country to confer with the cable companies with a view to improving the service; a number of suggested improvements are now under consideration. He states that there is no truth in the report that the company is about to amalgamate with the Anglo-American Co., or that the night cable letter system is likely to be adopted.

Wireless Telegraphy.—The "Orient" line steamers are being equipped with wireless on the Marconi system, the *Otranto* being the first so fitted.

The Chilian Government is about to install a wireless telegraph station on the island of Juan Fernandez (Alexander Selkirk's Island).

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 2nd. 1,820 private letter-box fronts for the P.M.G.'s Department in Victoria, Queensland, South Australia and Western Australia. See "Official Notices" June 17th.

MELBOURNE.—August 30th. Electrical sundries, insulators, wire and sulphate of magnesia, for the Deputy-Postmaster-General. Local representation. Specifications at office of High Commissioner, 72, Victoria Street, S.W.

September 7th. Battery material and glassware for P.M.G.'s Department in Queensland. See "Official Notices" to-day.

Barnet.—July 26th. Dynamos, motors, &c., battery, and wiring work, for the Guardians. See "Official Notices" July 8th.

Belfast.—July 27th. 3¼ miles of 7/18 high-tension cable, paper-insulated, and ¼ mile of 7/18 rubber-insulated ditto, for the Harbour Commissioners. See "Official Notices" July 15th.

July 27th. Independent surface condensing plant, with oil separator, &c., for the Harbour Commissioners. See "Official Notices" July 15th.

Belgium.—July 27th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the contract for electrifying the railway between Brussels and Haecht.

Chelmsford.—August 31st. Supplying and fixing wiring for lighting Trinity Road Schools by electricity, with alternative tenders for gas lighting, for the T.C. W. H. Pertwee, architect, The Institute, London Road, Chelmsford.

Chorlton.—July 26th. Replating accumulator at the Styal Cottage Homes, for the Guardians. See "Official Notices" July 15th.

Dublin.—July 29th. Twelve months' supply of machinery oils, for the Corporation Electricity Works. See "Official Notices" to-day.

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

July 27th.—The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of 150 tons of bi-metallic wire, 2 mm. diameter, and 100 tons ditto, 3 mm diameter.

Germany.—The municipal authorities of Breslau are about to invite tenders for the establishment of a central electric lighting station in the town, at an estimated cost of £30,000.

Hungary.—August 16th. The municipal authorities of Tolun are inviting tenders for the establishment of a small central electric lighting station in the town.

India.—August 3rd. The Secretary of State for India is inviting tenders for overhead floating staging and electrically-driven water-supply pumps. Conditions of contract from the Director-General of Stores, India Office, Whitehall.

Leith.—July 25th. One 500-KW. mixed-pressure turbine and D.C. generator, condensing plant and cooling tower, for the Electricity Department. See "Official Notices" July 15th.

London.—L.C.C.—August 30th. Wiring and fitting for electric lighting of the second section of the Woolwich Road car depôt. See "Official Notices" to-day.

Morecambe.—July 28th. Feeder pillars and arc lamp carbons, for the Corporation Electricity Department. See "Official Notices" July 15th.

Newport.—August 15th. Carbon-filament lamps, radiator lamps, flame arc carbons, and alternating and direct current two-rate and prepayment meters, for the Electricity and Tramways Committee. See "Official Notices" to-day.

New Zealand.—Power-house plant, cars, trucks and equipment, rails and fishplates, trolley wire and feeder cable, for the Invercargill B.C. See "Official Notices" July 15th.

December 15th. The contracts for the five wireless-telegraph stations mentioned in our issue of July 8th are now open for tender. Two high-power stations, with a range of 1,250 miles, capable of communicating with each other and with Sydney, and of receiving calls from Fiji, are to be erected at the extreme north and south of the island respectively, and three stations having a range of 500 miles are to be erected at Cape Farewell, Gisborne and Sumner.

Rochdale.—August 3rd. 4,000 tons of steam coal for the Corporation electric power station. C. C. Atchison, engineer and manager, Dane Street.

Spain.—July 30th. The municipal authorities of Malagon are inviting tenders for the concession for the electric lighting of the town during a period of six years.

August 16th.—The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment and working of a telephone line in the Linares district.

Walthamstow.—July 22nd. Six double-deck roof-covered tramcars, for the U.D.C. See "Official Notices" July 8th.

Whitehaven.—July 23rd. High-speed steam engine direct coupled to 250-KW. direct-current generator, for the Corporation. See "Official Notices" July 15th.

July 30th. Two superheaters to two existing Babcock & Wilcox boilers, for the Corporation. See "Official Notices" to-day.

CLOSED.

Bolton.—With reference to our announcement of last week regarding the Corporation Electricity Department meter contract, we understand that this has been divided up as follows:—

D.C. small-size meters.—Bastian Meter Co., and the Electrical Apparatus Co.
Larger sizes ditto.—Ferranti, Ltd.
A.C. meters.—Bat Meter Co. and the British Westinghouse Electric and Manufacturing Co.

Burton-on-Trent.—The Gas and Electricity Committee has accepted tenders for 20,000 tons of coal, at an average price of 10s. 7d. per ton, as against 10s. 4d. per ton last year.

Bury St. Edmunds.—The T.C. has accepted the tender of Messrs. Boby Bros. & Chapman, Ltd., for Portland best hard steam coal for the electricity works, at 19s. 8d. per ton, for a year.

Darlington.—The T.C. has accepted the tender of the Gilbert Arc Lamp Co., Ltd., for 56 arc lamps, at £5 16s. each. The company undertake to take back the lamps at the expiration of a year if they are not satisfactory, without charge; if they prove satisfactory the T.C. will pay 10s. per lamp in addition to the price of £5 16s.

Dartford.—Messrs. Royce, Ltd., of Trafford Park, have received an order from the *Daily Telegraph* paper mills, Dartford, Kent, for a gantry and electrical overhead crane with jib attachment, for unloading and stacking bales of paper-pulp. The span of the crane is 110 ft.

Dewsbury.—The T.C. has accepted the tender of Messrs. John Ake & Co. for 6,000 tons of coal for the electricity works.

Government Contracts.—The following tenders have been accepted by the Government departments named:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Batteries, boxes, &c.—Atlas Carbon Co., Ltd.; India-rubber, &c., Co., Ltd.; Siemens Bros. & Co., Ltd.
Indicators.—Elliott Bros.
Switches.—Thames Ironworks, &c., Co., Ltd.
Fifteen lifts for the battleships *Lion* and *Orion*.—Messrs. J. G. Childs and Co., Willesden Green.

WAR OFFICE.

Electric Cable and wire, &c.—Callender's Cable and Construction Co., Ltd.; Hooper's Telegraph and India-rubber Works, Ltd.; W. Rickard, Ltd.
Testing dynamos.—Laurence, Scott & Co., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Racks.—Bullers, Ltd.
Cables.—India-rubber, &c., Co.
Insulators.—Bullers, Ltd.

GENERAL POST OFFICE.

Telegraphic apparatus.—Brown & Murray, Ltd.
Telephonic apparatus.—Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.
Zinc battery plates.—Siemens Bros. & Co., Ltd.
Paper-core cable.—British Insulated and Helsby Cables, Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Western Electric Co., Ltd.
Fine-laid cord.—H. N. Lyons.
Electrically-driven air-compressing plant at G.P.O. (West), London, E.C.—Alley & MacLellan, Ltd.
Electric lighting of extension of Bristol Head Post Office.—Alexander Hawkins & Sons.
Installation of local telephone exchange equipment at telephone exchange, Monserrat Road, Putney, S.W.—Western Electric Co., Ltd.

STATIONERY OFFICE.

One electric copier.—L. Shaw.

COMMISSIONERS OF PUBLIC WORKS, IRELAND.

Electrical equipment of the new Royal College of Science, Dublin.—V. G. Middleton.

Heywood.—The Electricity Committee has accepted tenders for supplies of coal from Messrs. Smith & Gregson and Mr. John Chadwick.

London.—L.C.C.—It is reported this week that, as the result of the advertisement for the wiring and fitting for electric lighting of the second portion of the central car-repair depôt, only two tenders were received for the work, and after careful consideration it is recommended that neither tender be accepted, but that fresh tenders be invited from selected firms during the summer recess. The Highways Committee has authority to accept a tender.

The following tenders were received for the supply of low-tension cables, cable boxes, &c., in connection with the wiring for power purposes of the central car repair depôt:—

Western Electric Co. .. .. (recommended)	£949
Johnson & Phillips, Ltd.	980
W. T. Glover & Co., Ltd.	1,004
Siemens Bros. & Co., Ltd.	1,012
W. T. Henley's Telegraph Works Co.	1,016
B.I. and Helsby Cables, Ltd.	1,053
Callender's Cable and Construction Co., Ltd.	1,053
Estimate of Chief Officer	980

The Highways Committee reports the receipt of tenders as below for (1) 250 car bodies, (2) 250 car trucks, (3) 250 electrical equipments including the assembly of the car bodies, trucks and equipments. The lowest tender in each case is recommended for acceptance, namely, (1) that of the Brush Electrical Engineering Co., Ltd., amounting to £94,375 for the car bodies (200 to be of the class E.1, bogie doubled-decked type, and 50 in multiples of 10, either of the class E.1, bogie double-decked type, the class M, single truck, double-decked, four-wheeled type, or the class N, bogie single-decked type, as ordered by the chief officer of tramways, to meet the exigencies of the service, at the respective prices detailed in the tender); (2) that of Heenan & Froude, Ltd., amounting to £28,750 for the swing bolster trucks (200 sets to be of the bogie type, and the remaing 50 sets in multiples of 10, either of the bogie or four-wheeled type, as ordered by the chief officer of tramways, to meet the exigencies of the service, at the respective prices detailed in the tender); and (3) that of the British Westinghouse Electric and Manufacturing Co., Ltd., amounting to £83,812 for the electrical equipments, &c. The contractors in each case are to be allowed to sublet certain portions of the work.

(1) *Car bodies.*

Name of firm.	Price a car-body of the class E.1, bogie double-decked type, including a provisional sum of £15 a car for extra works.	Price a car-body of the class M, single truck, double-decked 4-wheeled type, including a provisional sum of £15 a car for extra works.	Price a car-body of the class N, bogie single-decked type, including a provisional sum of £15 a car for extra works.	Reduction a car-body if no supplementary side life-guards are fitted.	Total (contract) price.
	£ s.	£ s.	£	£ s.	£
Brush Electrical Engineering Co., Ltd.	337 10	352 10	265	4 15	94,375
Hurst, Nelson & Co., Ltd.	382 0	357 0	271	4 0	95,500
United Electric Car Co., Ltd.	420 0	382 9	293	2 10	105,000
Gloucester Railway Carriage and Wagon Co., Ltd.	425 0	386 0	266	2 5	106,250
Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd.	428 0 (In quantities of 200) 430 0 (In multiples of 10)	396 0	304	2 5	*107,100
Birmingham Railway Carriage and Wagon Co.	575 0	541 0	371	8 0	*143,750

* Schedules of rates of pay and hours of labour not filled in.

(2) *Car-trucks.*

Name of firm.	Price a set of bogie trucks, including provisional sum of £5 a set for extra works.	Price a set of 4-wheeled trucks, including provisional sum of £5 for extra works.	Reduction a set of 4-wheeled trucks if no slot brakes are required to be supplied.	Total (contract) price.
	£ s.	£ s.	£ s.	£
Heenan & Froude, Ltd.	114 0	119 0	23 0	28,750
Brush Electrical Engineering Co., Ltd.	122 10	118 10	13 0	30,625
Hurst, Nelson & Co., Ltd.	125 0	114 10	10 0	31,250
United Electric Car Co., Ltd.	127 0	117 0	13 13	31,750
"M and G" Truck and Engineering Co., Ltd.	136 0	118 10	9 10	34,000

(3) *Electrical equipment and assembly of cars.*

Name of firm.	Price a set including provisional sum for trolley equipments with £12 10s. for extra works and £12 for provision of ploughs, based on the equipments being erected on cars of the Class E 1 bogie roof-covered type.	Reduction a set for equipments required to be erected on cars of the Class M, 4-wheeled roof-covered type.	Reduction a set for equipments required to be erected on cars of the Class N, bogie single-deckeed type.	Total (contract) price.
	£ s.	£ s.	£ s. d.	£
British Westinghouse Electric and Manufacturing Co., Ltd.	335 5	0 5	0 2 6	83,812
Dick, Kerr & Co., Ltd.	340 0	0 15	0 5 0	*85,000
British Thomson-Houston Co., Ltd.	344 15	0 12	Nil	86,187

* Propose to supply interpole motors. The controller fingers are not quite to specification, and the schedules of rates of pay and hours of labour are not filled in.

It is also proposed to order 250 sets of magnetic brake equipments for these cars from the British Westinghouse Co., for the same price as paid for similar work on other contracts, which amounts to £14,250. The total amount of the accepted tenders will be £221,187, plus certain expenditure on the provision of ploughs, &c., which will be reported upon later. The cost of each car will be £883 15s., as compared with £884 15s., the cost of each car under the 1909 contracts.

For the alteration of the superstructure of Battersea Bridge, and the supply of special work in connection with the construction on the underground conduit system of electric traction of tramways from Battersea Park Road to King's Road, Chelsea, the following were the tenders :—

Dick, Kerr & Co., Ltd.	(recommended)	£6,844
Rowlingsons & Co...		7,365
Widnes Foundry Co.		7,439
Kirk & Randall		7,494
Patent Shaft and Axletree Co., Ltd.		7,619
Orr, Watt & Co., Ltd.		7,766
Andrew Handyside & Co., Ltd.		8,327
John Mowlem & Co., Ltd.		8,455
Alfred Thorne & Sons		8,544
W. Muirhead & Co., Ltd.		9,000
Head, Wrightson & Co., Ltd.		9,083
Perry & Co. (Bow), Ltd...		9,592
Edward Finch & Co., Ltd.		11,759

Chief engineer's estimate, £6,995.

The L.C.C. Stores and Contracts Committee has placed a contract for insulating varnishes for electrical purposes with the Maritime and General Improvement Co., Ltd.

HACKNEY.—The Electricity Committee recommends that feeder and distributing mains extensions be put in hand, also a new switchboard, for 1910-11, the total cost being £19,284. The cables will be purchased under the current contract with the British Insulated and Helsby Cables, Ltd., but tenders will be invited for the switchboard.

Newport (Mon.).—The T.C. has accepted the following tenders :—

General Electric Co.—Low-tension, high-tension and extra-high-tension switchgear, £3,063.
Messrs. Balcke & Co.—Cooling tower, £681.
Messrs. Babcock & Wilcox, Ltd.—Superheaters to six boilers, £915.
Albion Clay Co.—Four-way ducts, 3s. 11½d. per yard, less 2½ per cent. dis.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has ordered four "Bennis" stokers and self-cleaning compressed-air furnaces from Messrs. Ed. Bennis & Co., Ltd., of Little Hulton, for 8 ft. 6 in. Lancashire boilers at the generating station, Tame Valley, Stalybridge. This is a repeat order.

Twickenham.—The D.C. has accepted the tender of Stuart & Moore for the supply of three additional fire-alarm posts and connecting the same to existing indicators on the fire-alarm switchboard for £75.

West Bromwich.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for a new feeder main from the works to Spon Lane

West Ham.—The T.C. has accepted the following tenders for the installation of electric light at schools :—

Clarkson Street School.—Newbald & Co. (Stannos system), £153 10s.
Denmark Street School.—Weston & Sons, Ltd. (Simplex system), £136 11s.
Hallsville School.—Ditto, £115 13s.

Whitworth.—Mr. G. Law, of Kidderminster, quoted the U.D.C. £301 for work in connection with the tramway construction, and it has been decided to offer him £275 for carrying out the ordinary work, with an extra £45 for pitch grouting.

Worsley (Lancs.).—The tender of Messrs. Allman and Co. for the electric lighting of the new Town Hall and public offices, which are being built in Walken Road, Walkden, has been accepted by the District Council.

NOTES.

The new Channel Telephone Cable.—By the courtesy of Major O'Meara, the engineer-in-chief of the Post Office, we were afforded the opportunity on Friday last, the 15th inst., of observing the results of some comparative talking tests upon the new and the old telephone cables laid between Dover and Calais. The landlines for the new cable are not yet completed, and the tests were consequently made at the cable huts on the Abbot's Cliff, Dover. The cable contains two metallic circuits. On the French side these two circuits were connected together, thus forming one complete circuit, the terminals of which were brought to telephone instruments placed in separate buildings on the Dover cliff. Artificial cables were included in the circuit, one at each end of the line. These artificial cables permitted the introduction at will of the equivalent of 1 to 60 miles of test cable. The tests were made by Messrs. W. R. Cooper, W. Duddell, W. Judd and J. E. Kingsbury. Each conversed over the cable alone, and then included in the circuit successive units of the artificial cable until the limit of commercial conversation was, in his judgment, reached. The range of variation was from 20 to 24 miles of test cable at each end. The average was 21 miles at each end. A similar trial was then made with the old cable. In this case the range was from 12 to 13 miles at each end, the average being 12½ miles at each end. Thus the new cable permitted the addition of 42 miles of test cable and the old one of 25 miles of test cable. The artificial cables used in this test are the equivalent of a dry-core cable, the wires of which have a loop resistance of 88 ohms per mile, and an average mutual electrostatic capacity of 0·054 microfarad per mile between wire and wire of each pair. The cable has a length of 20 knots. The coils have 1 knot spacing, the first being ½ mile from shore.

The results shown by the new cable are eminently satisfactory, and the Engineering Department of the Post Office are to be congratulated upon the practical realisation of their scientific forecasts; the manufacturers of the cable are also to be congratulated upon the successful laying of a cable which is a new departure in submarine work. We are glad to be able to record that the first experiment on what may be considered a large scale has been made by Great Britain. Our thanks are due to Major O'Meara (the engineer-in-chief), to Mr. Kempe (the electrician), and to Mr. Pollard (the submarine superintendent) of the Post office for the facilities afforded, and the information kindly given to us.

Congress of Radiology.—On September 15th-17th an International Congress on Radiology and Electricity will be held at Brussels. A large number of papers has been promised, and a programme has been drawn up. Communications relating to the physical section should be sent to Prof. Rutherford or Mr. W. Makower at the University, Manchester. The general secretary is Dr. J. Daniel, 1, Rue de la Prévôté, Brussels.

Annual Sports.—The seventh annual athletic sports and children's carnival was held on 13th and 14th inst., under the auspices of the Liverpool Tramways Employés' Social and Thrift Society. Mr. C. W. Mallins, general manager of the tramways, was the chief moving spirit in the proceedings, and he was supported by the district traffic superintendents, Messrs. A. H. Anderson, J. Waters, A. G. Smart, E. McNulty and J. Butterfield. The Lord Mayor and Lady Mayoress, and Sir Chas. Petrie (chairman of the Electricity and Tramways Committee) were present. The children's festival was taken part in by 600 boys and girls, children of tramway employés. Music was provided by the Tramways Band (conductor, Mr. J. Farrell).

Institution and Lecture Notes.—LECTURES ON LAW RELATING TO ENGINEERING.—The Council of the Junior Institution of Engineers (Incorporated), in conjunction with the Council of the Society of Engineers (Incorporated), has arranged for a course of six fortnightly lectures on "The Law relating to Engineering," to be delivered by Mr. L. W. J. Costello, M.A., LL.B. (Cantab.), the first to be given on October 10th next.

Gas Poisoning.—The Report of the Medical Inspector of Factories shows that during 1909 there were 25 cases of poisoning in connection with gas power plant, of which four were fatal; in the previous year there were 19 cases, two being fatal.

Inquiry.—Makers of the "Redio" cleaning cloth are asked for

The Proposed Association of Consulting Engineers.—The following editorial comment on this Association, to which we refer in an article on another page of this issue, appeared in the *Times Engineering Supplement* on Wednesday:—"From the account which we publish to-day of the meeting . . . . it is seen that the proposal has among a certain grade of engineers met with some degree of approval. The suggested Association purports to have for its object the improvement of the status of the profession and the establishment of the profession upon a more satisfactory basis. At a time when existing institutions, thoroughly representative of the profession, are steadily working towards the reforms that the proposed Association has in view, it is doubtful whether the best interests of the public and of engineers would be served by usurpation of the prerogatives of institutions already established. One of the main objects is to secure that municipal and other public works shall be supervised by duly qualified professional engineers. With this object we cordially agree, and we have frequently advocated a policy on these lines. But it has to be remembered that the only chance of making such a reform effective is to establish not one authority, but a series of authorities, corresponding one to each of the great specialist branches of the profession—mechanical, electrical, architectural, and so forth. It is perfectly true that consulting engineers to-day are, in some instances, prepared to lay themselves out to be specialists in all directions, but this fact does not make such consulting engineers representative of the best that the profession can do in those directions. Thus it would appear that the most appropriate representatives of the common interests are the respective Councils of the leading institutions. The difficulty of getting the best results from a single concourse of experts and men of science is well illustrated by the way in which even the Royal Society have occasionally failed in their nominations. There has, in fact, been occasionally a tendency to nominate from the Council itself, instead of from specialist institutions. It is not a matter upon which we desire to dogmatise, but it seems desirable to urge that progress lies in the direction of adherence to the principle of specialisation."

Diseases of Electrical Workers.—During the past year there were 27 cases of lead poisoning in accumulator works, of which two were fatal. There were 29 such factories working under the Regulations of the Factory Department for dangerous trades, and the report of the Inspector shows that the principal Regulations were fully observed in all of these; irregularities were few, and were immediately remedied.

Nystagmus (oscillatory movement of the eyeball) has been observed in workers at electric lamp factories, employed in laying out metallic filaments, and in the flashing process.

Appointments Vacant.—Teacher for evening classes in electrical engineering, and magnetism and electricity, at the Great Eastern Railway Institute, Stratford, E.; senior assistant for the new electric generating station (45s.), junior assistant for same (28s.), second lecture assistant (£80) for the electrical engineering department, and assistant lecturer and demonstrator for the mechanical engineering department (£120) of the Northampton Polytechnic Institute. (See our advertisement pages in this issue.)

An L.C.C. Engineer's Invention.—Mr. A. Champion, an assistant in the electrical and highways branch of the chief engineer's department of the L.C.C., has been granted the Council's consent to his taking out patent rights in respect of an invention in connection with the construction of certain junction boxes and similar chambers, for the prevention of gas and water accumulation therein, on condition that the Council be allowed to use the patent without payment should it so desire.

Another X-Ray Victim.—An appeal has been issued, signed by several eminent surgeons and others, on behalf of Mr. F. S. Pepperdene, of Wimpole Street, London, who it is stated was one of the earliest experimenters in radiography and radiotherapy, but gave his valuable services freely to the City Orthopædic Hospital, London, and to the Eversfield Hospital, St. Leonard's-on-Sea. In the former institution he used his own costly instruments; indeed, the greater part of his work with the X-rays has been done gratuitously. In the pursuit of his labours he contracted X-ray dermatitis, and after very much suffering has had to lose his left fore-arm. This loss will dreadfully handicap Mr. Pepperdene in his work, and render it almost impossible for him to continue it. His outlook is darkened by the fact that the other hand is affected, and that he has a wife and five children entirely dependent upon him. An effort is being made to raise a capital sum of £2,000. Subscriptions may be sent to Rev. E. H. Leale, vicar of St. Stephen's Church, Bexhill-on-Sea.

Sir William Treloar has issued a fresh appeal on behalf of the Cox Fund, which he hopes will be augmented for the benefit of Mrs. Cox and her children.

Electric Thermometers in Concrete.—Six resistance thermometers will be embedded in the walls of the locks at Gatun, Panama Canal, in order to determine the degree of heat attained at various stages of the hardening of the concrete. By this means data will be obtained in relation to the heat produced by the chemical changes coincident with the hardening of the concrete.—*Electrical World.*

Swedish Radium.—The director of the Swedish radium factory near Islinge, on the Island of Liding, has informed a Stockholm newspaper that the first quantity of radium, consisting of 5 centigrammes of radium bromide, is on the point of being forwarded to the Banque de Radium, in Paris. It appears that the Swedish Radium Co. has concluded an agreement with the Paris Bank, whereby the latter is to receive delivery of all the radium produced by the former in Sweden. The preparation is dispatched in tubes of platinum-iridium, as it has been found that gold tubes have an insufficient power of resistance. The director is also reported to have stated that the company by way of experiment has procured raw material from America and Australia, but the Swedish mineral "kolm" possesses decided advantages, as it is easier to work, and the radioactive material occurs in it more frequently.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

General.—The Highways Committee of the L.C.C. in its minutes makes the following announcement:—"We report with regret the resignation of MR. J. H. RIDER of his position as tramways electrical engineer, to which he was appointed in 1901. Mr. Rider has accepted an important appointment in South Africa. In view of the eminent services rendered by Mr. Rider in connection with the electrification of the Council's tramways, we think that the Council, in accepting his resignation, would desire to place on record its high appreciation of the work done by him. We will report at a later date as to the steps to be taken to fill the vacancy. We recommend—That the resignation of Mr. J. H. Rider, electrical engineer in the tramways department, be accepted with an acknowledgment of the valuable services rendered by him in connection with the electrification of the Council's tramways system; and that the resignation do take effect as from August 31st, 1910." Mr. Rider is proceeding to Johannesburg early in September for a prolonged period for Messrs. Wernher Beit & Co. (H. Eckstein and Co., Johannesburg) to act in an advisory capacity in connection with electrical and mechanical engineering matters. As our readers are aware, the power station construction period of the L.C.C. tramways department is practically at an end. To settle down to the monotony of routine work, even in so important a position as he has held, would hardly be congenial to one of Mr. Rider's restless zeal for designing, so it is not surprising that the very favourable offer that has been made to him is acceptable at the present juncture. We are sure that the very large number of friends that Mr. Rider has made during his periods of service in London, Plymouth, Bolton and elsewhere will join with us in wishing every success to him in his new sphere.

MR. W. J. DAVIES, of Messrs. William Beardmore & Co., Ltd., Parkhead Forge, Glasgow, has received the appointment of chief electrical engineer to Messrs. Julian Kennedy, Sahlin & Co., Ltd., Brussels, for the laying down of a 4,000-KW. plant for the Tata Iron and Steel Co., at Sahchi, near Kalimati, Bengal. He will sail in August.

MR. WALTER H. DERRIMAN, B.Sc., A.C.G.I., A.I.E.E., Fellow of the Chartered Institute of Patent Agents, has entered into partnership with Messrs. Dicker & Pollak, Chartered Patent Agents, of 37, Furnival Street, Holborn, E.C., and, in consequence, the name of the firm has been changed to Dicker, Pollak & Derriman. Mr. Derriman is personally taking charge of the electrical business of the firm.

It was announced at the meeting of the Telegraph Construction and Maintenance Co. on Tuesday that LORD SELBORNE had accepted the position of chairman of the company.

Central Station Officials.—At the Hylton Road electricity station, Sunderland, on Thursday night last week, MR. HARRY WEBBER, late works superintendent, was presented with a gold chronometer stop watch by the staff of the Sunderland Corporation electricity department, on his leaving the latter's employ to take up the important position of borough electrical engineer at Keighley, Yorks. The presentation was made by the borough electrical engineer and manager, Mr. Alfred S. Blackman, who spoke of the good qualities of Mr. Webber, and wished him success in his new sphere. Mr. Windle, assistant engineer, Mr. Crowther and Mr. Donkin also spoke a few words, and Mr. Webber suitably responded.

The Stafford Gas and Electricity Committee has recommended that the salary of MR. R. E. MEADE, chief electrician, be increased from £175 to £200 per annum, as from March 31st last.

The Birmingham Corporation Electricity Committee has unanimously decided to recommend the City Council to appoint MR. HOWARD FOULDS to the position of secretary of the electric supply department. As many of our readers are aware, Mr. Foulds has held the position of secretary to the Faraday House Electrical Standardising, Testing and Training Institution for the past 16 years, and, in addition to this, he has served as a member of the Holborn Borough Council, and as a poor law guardian to another London borough. We learn from Mr. Chattock that 322 applications were received for the post.

(*Continued on page* 143)

INSTALLATION OF LARGE BATTERY AND BOOSTERS AT DICKINSON STREET ELECTRICITY WORKS, MANCHESTER.

By S. L. PEARCE.

Too much has been made in the past of the comparatively low efficiency of a storage battery. Its efficiency when used essentially as a peak load or load-levelling apparatus, becomes of secondary importance when it is realised that the saving in generation costs far exceeds the losses on the battery-booster plant.

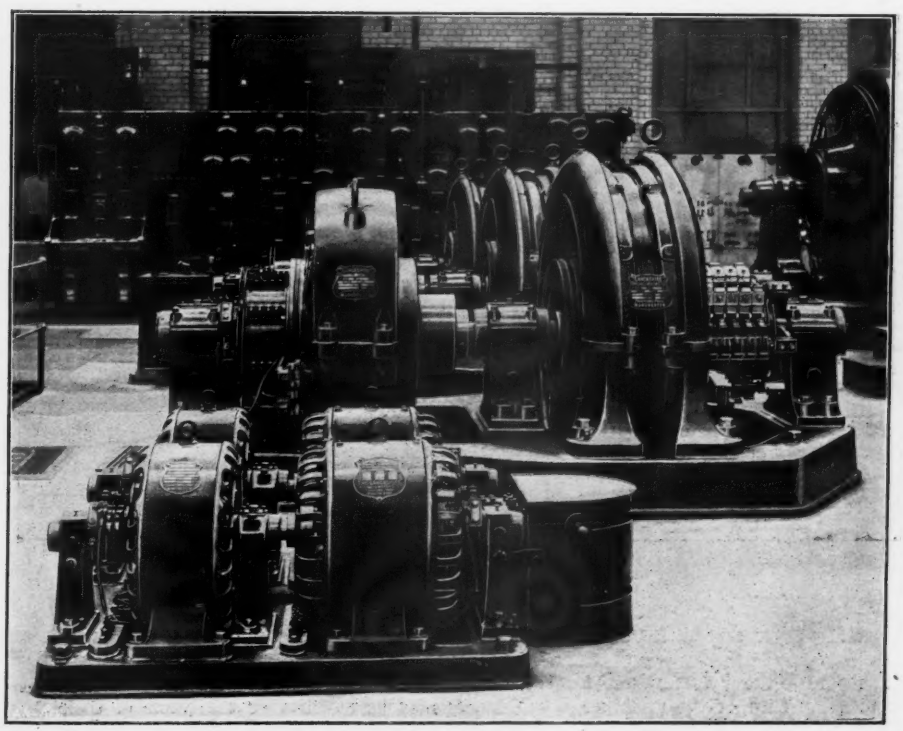
Battery makers can now obtain and guarantee something like 90 per cent. ampere-hour efficiency, and a commercial efficiency, including boosters, closely approximating to 70 per cent.

The general details of the large Tudor battery and automatic reversible boosters which have been installed at the Corporation Electricity Works, Dickinson Street, under the contract of the Tudor Accumulator Co., Ltd., of London, are as follows:—Maximum battery discharge rate, 15,000 amperes for five minutes; capacity at 10-hour rate of discharge, 16,500 ampere-hours; one-hour rating, 8,400 amperes. Each cell contains 77 plates, and there are 210 cells. The total weight of the 210 cells is 700 tons.

The most striking feature about these cells is their unusually large size, each cell being 6 ft. 1½ in. × 2 ft. 2½ in. × 3 ft. 4½ in. deep. They rest on glass oil insulators placed on four runners of pitch pine, which in turn are supported on large porcelain oil insulators. The containing boxes are constructed of pitch pine, panelled and dove-tailed, and coated inside and out with acid-proof paint, and lined with sheet lead.

The positive and negative plates, which are of the standard Tudor construction, measuring 29 in. × 20¾ in., are supported by means of their lugs on ⅜-in. vertical glass plates, and are kept apart by means of wood board separators. To allow for the accumulation of deposit a space of 8 in. is allowed beneath the plates. The method adopted for the connecting together of the plates of adjacent cells is the usual one of burning the lugs on to lead-connecting bars. Six copper rods (round section of 1·4 sq. in.) are employed to connect the various rows together, and are so arranged that they are equal in length in order that each rod will carry its due share of the current. Junctions are made to the heavy lead-connecting bars by sweating the rods into lead cups.

VIEW IN BATTERY ROOM (LOWER FLOOR).



GENERAL VIEW OF THE BOOSTERS AND SWITCHBOARD.

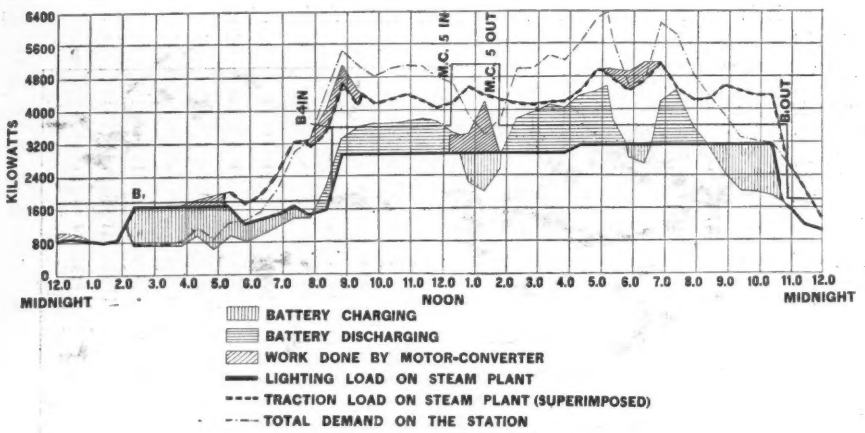
The battery house is about 75 ft. long × 63 ft. wide, and has two floors; the main floor covers the full area of the building, and the top floor measures 42 ft. 6 in. long × 26 ft. 6 in. wide.

Owing to lack of space it was decided to erect the battery house over the old Lancashire boiler house, the roof of which was covered by water tanks carried on eight steel-plate girders; the weight of water in the tanks,

when full, was about 900 tons—the weight of the battery house and cells to be carried by the girders is about 1,050 tons.

It was decided to rearrange the circulating water system at the station, and to empty the tanks and carry the battery house on the tank girders. An examination proved them to be in good condition, and with slight repairs and strengthening they were made sufficiently strong to carry the additional load put upon them. Steel stanchions were placed under the ends of the girders to relieve the load on the walls of the boiler house.

The main floor is composed of steel joists and arched concrete, covered with a layer of special acid-resisting asphalt.



Typical Summer Load Curve.

The top floor is of steel girders and joists and open timber battens. The walls are of brick with windows in all four sides. The roof is of steel rafters with timber purlins, and roof boarding, covered with Grave's patent roofing felt.

Ample ventilation has been provided by opening casements in windows, and a line of opening shutters round the upper portion of the sides of top floor. Further ventilation is provided by a louvre ventilator in the highest portion of the roof, and by air-bricks placed at the top and bottom of the walls at frequent intervals. Special paint has been used throughout to resist the acid fumes.

There are 178 cells on the main floor and 32 on the top floor, the cells weighing slightly over 3 tons each.

The booster sets, of which there are three, are of the Turnbull and McLeod automatic reversible type, and were manufactured by the Lancashire Dynamo and Motor Co., Ltd. The motor and booster of each set are mounted on a single bed-plate, and are interpole machines, the motors being shunt-wound, and the boosters separately excited from two small exciter sets or from the bus-bars, as the case may be.

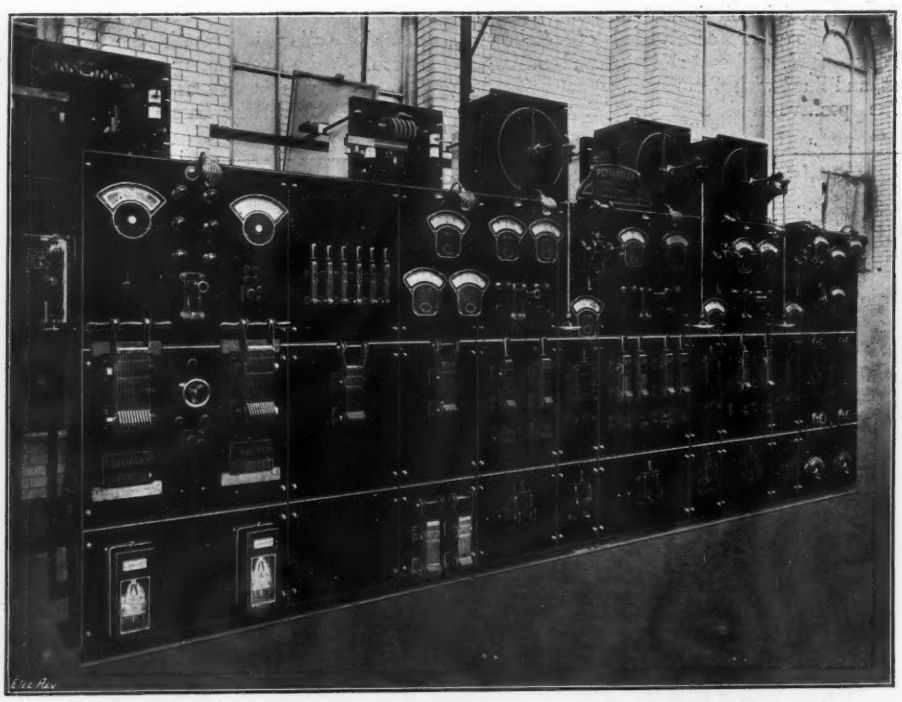
An interesting feature with regard to the boosters is that they have equalising rings to every turn of the armature windings on account of the heavy circulating currents. The yokes of the boosters are laminated, in order to allow for rapid reversal of the field.

The motors run either off the lighting bars at 425—450 volts, or the traction bars at 525 volts, and the following are the specified outputs for the boosters :—

2,000	amperes at	80	volts for	4 hours
2,800	,,	60	,,	1 ,,
2,700	,,	80	,,	½ ,,
2,800	,,	100	,,	¼ ,,
5,600	,,	80	,,	3 to 5 minutes.

When the battery is on lighting load, one booster (or two or three in parallel) is used, according to the load, and is then capable of maintaining a voltage of 450 across the lighting bus-bars. Regulation is effected by hand, by means of a resistance of large range placed in series with the booster field, which is excited either from the bus-bars direct or from the exciter sets.

When on traction load any one (or two in series) of the boosters may be connected, and the regulation of the discharge and charge is automatic. Excessive loads are thus provided for by a discharge, and light loads compensated for by a charge, and consequently, conditions are so maintained that the generators have a continuous steady load. This state of things is brought about by means of the small exciter generators, whose fields consist of three distinct windings, two of which are shunt windings, one across the booster, and another across the bus-bars. The function of the former is to compensate for variation in the battery voltage, and it reverses itself according to the direction of current in the booster; the latter always tends to charge the battery. The third winding is in the form of a heavy copper strip of one turn in series with the negative traction-bar, and has a diverter composed of six resistances in parallel with it. Any number of these resistances may be inserted, or the whole of them may be short-circuited through a switch. This series winding com-



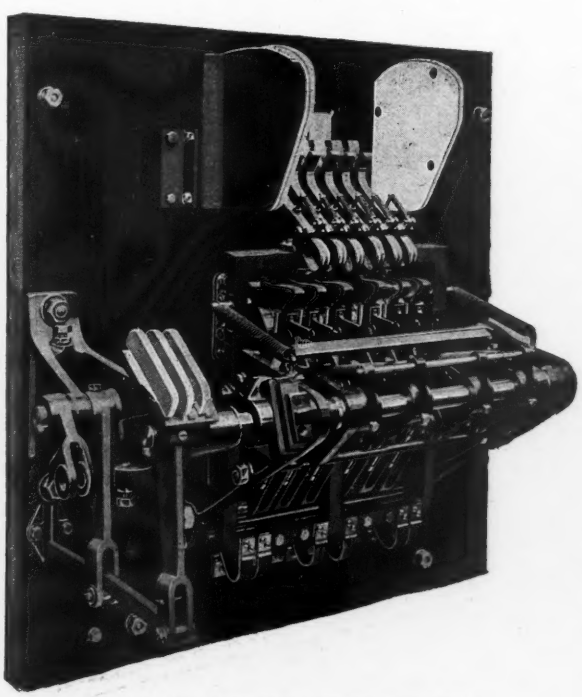
Ferranti Battery Switchboard, Dickinson Street.

pensates for fluctuations of the traction load. If when discharging, the load falls below certain limits, the series winding is weakened to such an extent that it is neutralised by the shunt winding which opposes it, the booster current is then reversed, and the battery begins to be charged. The diagram of connections for the complete scheme is shown on page 142.

Messrs. Ferranti, Ltd., of Hollinwood, Lancashire, were responsible for the erection of the switchgear. Their design presents many noteworthy and interesting features, especially on account of the unusually heavy currents that have to be dealt with.

In order to cope satisfactorily with the heavy emergency outputs which may be necessary from the battery, and yet to avoid clumsiness in design, many new departures from the ordinary methods of construction have been employed. In the first place, it was considered desirable that positive and negative circuit-breakers, enclosed in separate concrete cubicles, should be placed immediately adjacent to the battery house, and connected in on the battery leads, so as to provide for the complete isolation of the battery when necessary. These are non-automatic, but can be operated electrically from the battery board, and are capable of carrying 15,000 amperes continuously. Magnetic blow-outs are provided on them.

The main cables are run from these circuit-breakers,

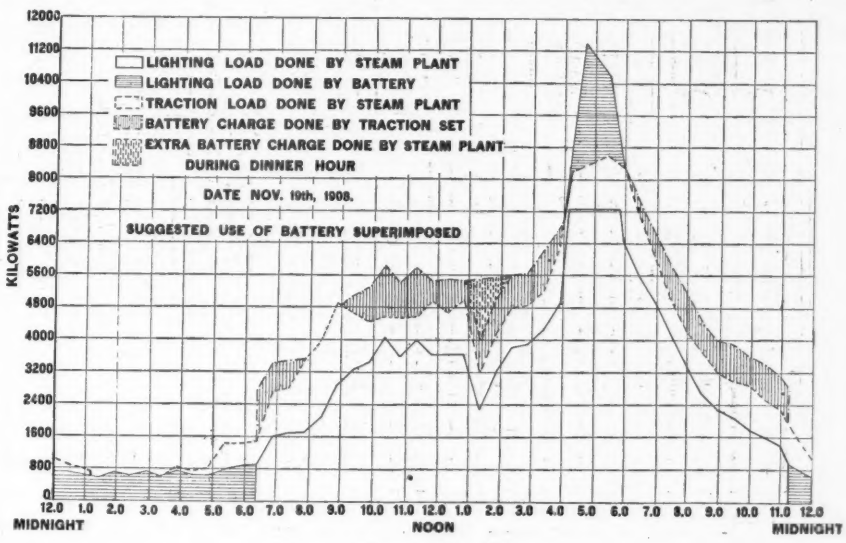


15,000-AMP. FERRANTI CIRCUIT BREAKER.

supported on porcelain clamps, underneath a new gallery and stairs, to the battery board where they are connected to the automatic circuit-breakers.

The battery board itself consists of 10 panels. From the main battery panel, the automatic circuit-breaker of 10,000 amperes capacity is operated mechanically or electrically, and below it are the two single-pole switches with change-over contacts for lighting and traction. These switches are simply knife switches composed of many laminations. When closed, the bolt passing through the blades can be tightened up, and an exceeding good contact is the result.

Adjacent to the battery panel is the diverter panel, having six 500-ampere knife switches and a 6,000-ampere short-circuiting switch. Then follow the booster and motor panels alternately—a 4,000-ampere automatic circuit-breaker



TYPICAL WINTER LOAD CURVE.

being operated from each of the former, and also a 3,000-ampere change-over switch. The circuit-breakers are contained in concrete cubicles placed at the back of the board. In order to avoid the risk of the motor breaker operating and leaving the booster in circuit, the booster and motor breakers for each booster set are electrically interconnected, so that both operate simultaneously.

The exciter motors and generators are controlled from the two remaining switchboard panels.

There are many striking features to be noted in connection with the methods of construction adopted at the back of the board. Bus-bars of aluminium have been employed throughout, consisting of several wide strips firmly bolted together with distance pieces between. The bars are enclosed in concrete troughs, and are carried on cast-iron brackets, with rubber sheets and porcelain as intermediate insulation.

Much might be said with regard to the connections of the cables and bus-bars to the switches and circuit-breakers, and the methods employed to avoid serious heating, but a brief word must suffice in order to avoid an unnecessarily detailed account. In the case of the battery change-over switches, the connection to the middle contact is made by continuing it through the panel in the form of copper strips clamped together, and through these are bolted the cable lugs. These lugs are conical in form and fit into tapered holes, drilled through the copper strips, and thus a large contact area is obtained.

Contacts in all cases are obtained by bolting together plane surfaces that have been trued up.

It has been found possible since installing the battery to reduce the number of boilers in use at Bloom Street station, and to shut down the Dickinson Street boilers altogether, relying on the high-tension station at Stuart Street for all extraordinary demands due to storms or sudden darkness. On page 140 is given a load curve for a normal day in summer, which shows clearly the way in which the battery is utilised. A similar load curve for the winter is shown above, with the proposed method of operating the battery indicated thereon.

Not only is the load on the Bloom Street plant kept constant for at least 10 hours out of the 24, but much is being done to level the load at the high-tension station in addition.

When the mills, factories and works generally go off at mid-day for the workmen's dinner hours, a heavy charge, supplemental to that from Bloom Street, is put into the battery from Stuart Street, and is made to partially fill up

this gap on the Stuart Street load curve. The link between the City D.C. stations and the high-tension three-phase station at Stuart Street is made by means of four 500-KW. and three 1,800-KW. Bruce Peebles motor-converters (La Cour-Bragstad patents); it allows of considerable elasticity between the stations, and is a great help to the economy of the system as a whole.

The load factor on the steam plant for Dickinson Street and Bloom Street combined stations for the period of last year corresponding to the present was 34·5 per cent. Since the installation of the battery this has been raised to over 50 per cent., and the coal consumption at the city stations reduced from a monthly average at this time of the year of $3\frac{3}{4}$ lb. of coal per unit generated to slightly under $2\frac{3}{4}$ lb. per unit generated, after deducting units lost in battery. These results are expected to be improved upon, as the staff get more experienced in the use of the battery.

It will be noted from the charts shown that they are succeeding fairly well in getting two discharges a day and levelling up the night load with the main charge.

It should be very clearly understood that the efficiency of a storage battery depends more on the way it is used than on the way it is constructed.

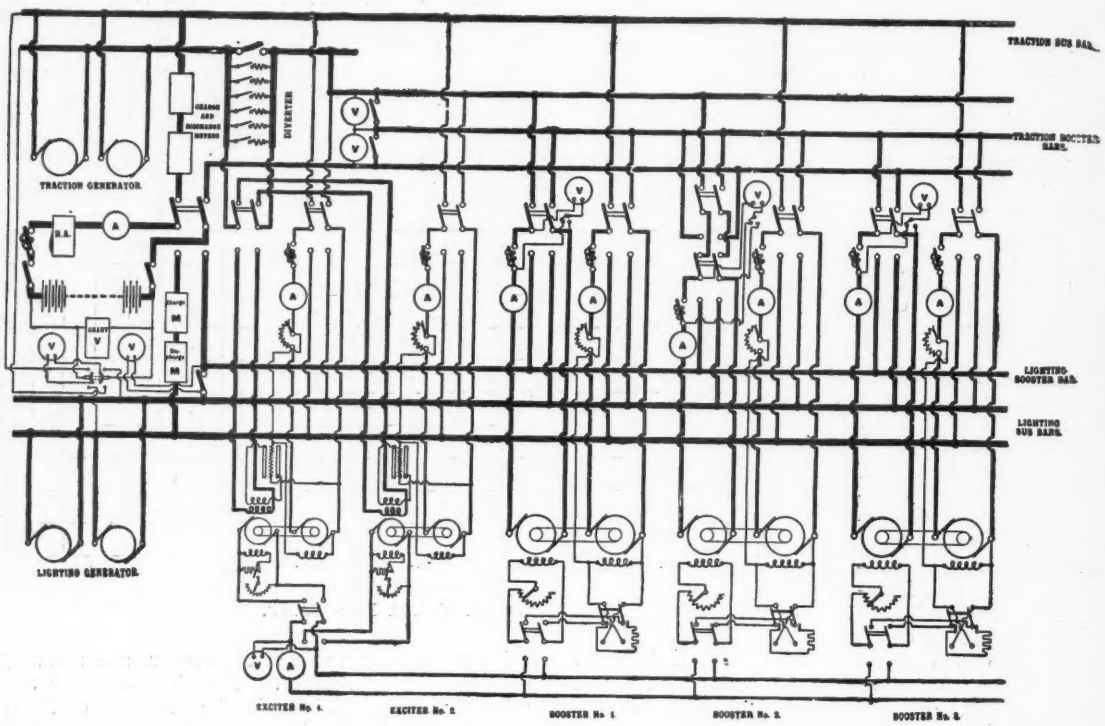
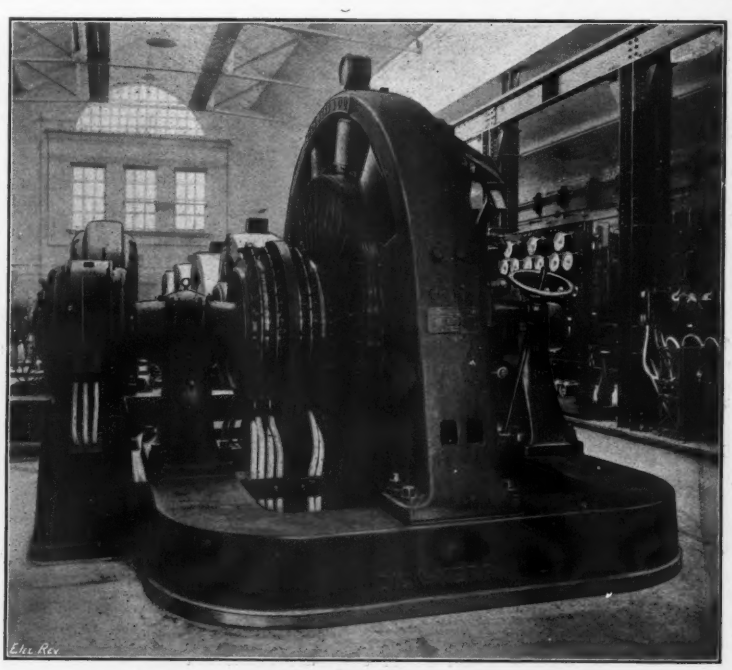


DIAGRAM OF CONNECTIONS OF COMPLETE SWITCHBOARD.

HIGH-SPEED ROTARY CONVERTERS.

THERE has been a growing tendency for some years past towards gradually increasing the speed of electrical machinery, and this development is not confined to generators, but has equal application to motors, motor-generators and rotary converters. An interesting example of high-speed converters is at the Elephant and Castle sub-station of the London County Council tramways, where two machines of 1,500 KW. capacity running at a speed of 250 R.P.M., 25 periods, have been operating successfully for some time past. The notable feature in the design is the absence of auxiliary poles. The overload capacity is 1,875 KW. for six hours and 2,250 KW. for 30 min., the field regulation being from 530 to 575 volts D.C. The rotaries work in parallel with induction motor-generators, the fields of which are shunt wound. Each set is started by an induction motor mounted on the same shaft as the rotary. The machines, which have been supplied by Messrs. Dick, Kerr & Co., Ltd., are of generous proportions, and mainly follow the general design employed by this firm.



DICK, KERR 1,500-KW. ROTARY CONVERTER, L.C.C. TRAMWAYS.

The field is shunt wound and the coils are carried on strong detachable formers. The armature is built up on a solid spider, the windings being laid in open parallel slots with locking strips dovetailed into the tops of the slots.

OUR PERSONAL COLUMN.

(*Continued from page* 138.)

Tramway Officials.—The salary of MR. G. F. CRAVEN, assistant engineer of the Reading Corporation tramways, has been increased from £160 per annum to £180 per annum, to rise by two further annual increments of £10 each to £200 per annum.

MR. W. J. MCDONALD, traffic superintendent under the Colchester Corporation, has been appointed traffic superintendent of the Burton and Ashby light railways.

The Warrington T.C. has increased the salary of MR. TELFER, tramways manager, from £208 to £234 per annum.

Obituary.—The mortal remains of the late MR. ALFRED E. IZARD, Prof. R.A.M. and joint Musical Director Electro-Harmonic Society, were laid to rest on Saturday last at Brookwood Cemetery. The relatives present at the grave-side included the son of the deceased, sister, brother-in-law, eldest brother, Mr. Fred. Izard, and his uncle, Mr. Fred. Walker, R.A.M., and aunt. The Electro-Harmonic Society was represented by Mr. Robert K. Gray (treasurer), Mr. H. Alabaster and Mr. T. E. Gatehouse (joint Musical Director). Many beautiful wreaths were sent by the Committee of Management (R.A.M.), the deceased's brother professors and pupils (R.A.M.), the Directors of the Beckenham and Bromley School of Music, and his pupils at this Institute, the Blackheath Conservatoire of Music, the London Academy of Music, City Glee Club, Lothbury Male Voice Choir, the Electro-Harmonic Society, and by numerous professional and private friends and relatives. Amongst those who attended the last sad rites were Mr. Ormond Yearsley, secretary, Beckenham and Bromley School of Music, Mr. Sidney Hann (R.A.M.), Mr. William Forington (Temple Church), Mr. Alfred Moore, Mr. T. Evison (conductor, Lothbury Male Voice Choir), Mr. Patrick White, LL.B., J.P. (conductor, Woking Musical Society), and others.

NEW COMPANIES REGISTERED.

John Rattray & Son, Ltd. (7,609).—This company was registered in Edinburgh on July 12th, with a capital of £4,000 in £1 shares, to take over the business carried on by John Rattray & Son, Glasgow, as house and ships' plumbers, gasfitters, and electrical engineers. The subscribers (with one share each) are:—G. McKinlay, 21, University Avenue, Glasgow, plumber; H. R. Hayes, Woodneuk, Barrhead, electrical engineer. Private company. The number of directors is not to be more than seven; the first are G. McKinlay and H. R. Hayes; qualification, 100 shares. Registered by Oswald & Sons, Edinburgh.

Bracuhy Falls and Metallurgical Syndicate, Ltd. (110,780).—This company was registered on July 14th, with a capital of £48,000 in £1 shares, to carry on the business of concessionaires, promoters, constructors and workers of tramways, railways, telegraph and telephone lines, and electrical works, electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (with one share each) are:—B. Elliott, 7, Bouverie Road, Stoke Newington, N., cashier; F. Harwood, 27, Arthur Road, Holloway, N., clerk. Private company. The subscribers are to appoint the first directors; qualification, 3,000 shares. Registered by Slaughter & May, 18, Austin Friars, E.C.

CITY NOTES.

General Electric Co., Ltd.

THE annual meeting was held on Tuesday at the offices in Queen Victoria Street, E.C., Mr. G. Byng presiding.

The CHAIRMAN, in submitting the balance-sheet for the year ending March, 1910, said:—We are glad to show a good increase of profits, £95,000 this year, against £78,000 last year, a difference of £17,000. The appropriation of the available balance has been the subject of much consideration, and we have decided to propose as hitherto a dividend of 5 per cent. on the ordinary shares. We are increasing our reserve fund by £22,000, and have commenced a new policy of carrying forward a substantial sum. These measures will considerably strengthen our financial position. We are bound to increase in order to keep abreast, even to a limited extent, with the powerful foreign electrical firms, and are often called upon to find large sums at short notice. Hitherto we have used our credit for such purposes, but in future we intend to invest part of our reserve fund in convertible securities, which we hope will enable us to rely upon our own resources. The balance carried forward exceeds £8,000, enough to cover the full amount of interest on our debentures. This conservative policy especially will strengthen the position of our preference shareholders, and I trust that the quotation of the preference shares will soon represent their intrinsic value. I have before me several letters with regard to the quotation of our preference shares, which as some of you know, are quoted at a very low figure in the Stock Exchange list, a matter of some surprise to me as well as to many other people. I have found out that several stockbrokers—so-called outside stockbrokers—have been offering our shares for reasons of their own, I suppose to make a market or to advertise themselves, without having those shares. I have lately each time bought those shares when they were offered, but I have never been able to get them. Yet I have found that the same outside brokers have been—after having my acceptance of the order—writing to all the shareholders offering to buy their shares at a very low figure, but they have never been able to get them. Therefore, the price quoted was not a true one, but it must have frightened some of our shareholders, which is a great pity, and I hope they will not throw their shares upon the market in this fashion. The figures in the balance accounts differ somewhat from those of last year. The credit side shows a reduction both in property and stock-in-trade; this is due to the transfer of Peel works to a subsidiary company, the shares of which increase our investments by a corresponding amount of £60,000. We have transferred from these works to our engineering works at Witton the manufacture of switchgear, arc lamps, fans and small motors. We have considerably enlarged Witton Works for this purpose, and believe the new working arrangements will prove beneficial. This change has been necessary through the great increase in our telephone business, and we particularly welcomed it, as it enabled us to unite at Witton most of our departments dealing with electrical light and power installation, and we are convinced that, through this amalgamation of departments under one roof, we shall save considerably in running expenses. Your directors are proud of the success which we have lately achieved in the production of telephone exchange equipments. The English telephone industry has, in the past, been in an ignominious position. We have been especially well fitted to produce telephones, and in the inception of the industry England was far ahead of any other country. Yet this important industry has been strangled in its infancy, and for over 20 years the English and Colonial telephone companies have had to buy all their equipments and instruments from foreign makers. I am pleased to say that a change has at last been made by the British Post Office. They have been very far-sighted in insisting on getting English-made apparatus in spite of deep-rooted prejudice, due mainly to mistaken notions in regard to the economic aspect of the question. The G.E.C. especially has to thank the Government for much encouragement. The result has been most satisfactory to both parties. We have now completed the installation of one of the largest and most important telephone exchanges in the kingdom, every particle, every screw, being made at our Salford Works—as well, and I am assured, even better than, the foreign equipment which held the monopoly for 20 years. We have also nearing completion the installation of another Post Office Exchange. Further, we have well in hand an Exchange equipment for the Australian Commonwealth, and we have supplied similar plant to the Indian Government. Besides these Exchange equipments we have manufactured, and are manufacturing, large quantities of telephone apparatus for the British Post Office and the Colonies. Moreover, the apparatus is to designs prepared by the company, in no way imitations of the standard patterns, but our own. But the strangest part remains to be told. The prices at which the Post Office is now buying in England are far below the foreign prices paid formerly. For instance, instruments previously supplied by the foreigner are now produced in this country and sold at rates lower than the old prices by various percentages running up as high as 30 per cent. I believe that the history of telephones is a greater condemnation of Free Trade policy than anything else if people only knew how stupid it has been to buy abroad for 20 or 30 years articles which we could produce here and for no reason whatever, simply in the belief, the stupid belief, that we could buy them cheaper. The far-sighted officials of the Post Office have put their foot down, and have enabled the English manufacturers to produce at no favour or particular advantage, but simply on the same terms and lines as the foreign firms have been manufacturing, and they find out to their great surprise, or to the great surprise of other people, that we actually can manufacture cheaper and better than abroad. Why, then, do we buy abroad? It only shows how stupid this country is to think we can get them cheaper. We do not do so. We can get them just as cheaply here, or cheaper than anywhere else. This will explain why we have devoted the whole of Peel Works to the manufacture of telephone apparatus, and we are carrying it on now as a subsidiary company called the Peel-Conner Telephone Works, Ltd., under the able management of Mr. M. S. Conner. A number of shareholders and friends of the G.E.C. have likewise associated themselves with us in the Peel-Conner Co. The transfer of these works explains the increase in our investments, and as this transfer has been too recent to show a year's working, it will also explain why the dividends on investments have not increased. Our biggest enterprise, the Witton Engineering Works, has turned out very good work, and its excellent staff and workers have again increased the reputation of our products throughout the world. We have erected some big plants not only at home, but in the Transvaal, Australia, India, the Argentine and the East. It is unfortunate that the prices ruling are still unremunerative; we have to rely less upon competitive prices than upon the excellence of our plant We are keeping the flag flying over our carbon works, although they have not yet been able to show a profit in face of foreign competition. The advent of the flame lamp has helped us very much and in the making of flame carbons we have succeeded in beating the quality of almost all our Continental competitors. We have been greatly encouraged by the policy pursued by the Admiralty, who have recognised the importance of a carbon factory in England. Their example is now being followed by most Government departments, but we have much to complain of in the action of many municipalities. It is a matter of great regret that these municipalities are allowed to send the ratepayers' money abroad while so many of our own workers are unemployed, and whilst it is a matter of almost national importance that the only carbon works in this country should be kept going. We have increased our foreign depôts and agencies in order to find outlets for our large factories. The preferential duties in Canada and Australia have been of very material benefit to us and have helped in the employment of hundreds of workpeople throughout the year. There will soon be an Imperial conference, and as an exporter and

employer of labour, I wish to urge the great necessity of further extending such preferential duties, and I hope that the Government will be able to include our great dependencies and Crown Colonies, India, the West Indies, Africa, &c. The sale and influence of the Osram lamp have fulfilled our expectations; the wonderful efficiency of this great invention has reduced the cost of electric lighting to less than that of gas. Thousands of Osram lamps are in use to-day that have burned over 6,000 hours—a durability truly astonishing. We regret to say, however, that our patent rights have been greatly infringed. We have been compelled to take legal proceedings against infringers both on the master patent as well as upon minor patents, of which there are many. There are some few methods differing from ours by which metal-filament lamps can be produced, but most of those that are imported are held by our experts to be distinct infringements of our patents. The public in general cannot discriminate, but, of course, they are running great risks in buying lamps that may infringe patent rights. A country's fiscal policy has a great influence upon its industries—the fortunes of our own undertaking, the G.E.C., depend in a large measure upon our national commercial policy. As I am convinced that our present policy is bad for us, I hold it a duty to bring before the public my views at our annual meetings. I have done so for many years past. Let me note with regret that during the last year a policy that is opposite to the interests of the manufacturing industry of this country has been adopted. My plea has been to restrict unlimited foreign competitions, to regulate our imports, and to obtain a contribution towards our taxation from the foreign producers that have the use of our markets. Instead of pursuing this policy, increased taxation has been laid upon the home producer, and that to an unprecedentedly large extent, while the foreigner dealing in this country remains as free from taxation as before. The inequality of the two users of the British markets—the home and the foreign manufacturer—has thus been increased to the detriment of the home producer. The G.E.C. is one of the heaviest rated industrial concerns in the kingdom, and we are called upon to pay enormous sums, while those who compete with us for the supply of exactly the same goods in this very country have not to pay any taxation whatsoever, neither income-tax, nor provision for death duties, nor rates for keeping our poor, nor rates for our schools or roads, nor for our Navy, Army or Government. Add to this, that when we buy from foreign producers goods we could make ourselves, we enable them to produce upon a larger scale, while correspondingly we have to produce upon a lower scale, and we thus give them the immense advantage of lower cost of production. Mere figures as those of our Board of Trade returns, or even of a balance-sheet, may be some limited indication of the past and the present, but they are no guide to the future. Experience and intimate knowledge of business are required to gauge the likely course of events, and the knowledge that the manufacturers of this country hold must clip the wings of resource and enterprise, and must tell them to be afraid of the future. What we manufacturers lack under our fiscal system is the sense of security. I am told that the handsome results of our yearly balance-sheets give the lie to my contentions—that having prospered under Free Trade I should be the last person to wish to alter it. I think this method of arguing is wrong. If it is true that the prosperity of the G.E.C. is wholly or partly due to Free Trade, and I, in spite of this, wish to advise a change—that alone should impress people, and made them think that I have powerful and unselfish reasons for advocating a change of system which seems to suit my pocket so well. The result of our last two years' balances have been called good. Considering the difficulties under which we have to work, they certainly reflect credit upon the diligence and knowledge of the management, the staff, and our workpeople. But I say they could be better, far better. Our capital results could be better, our future outlook could be more secure, and we could employ double and treble the number of workpeople we do now. This I say not from guesswork but because I know the results achieved by our competitors who are working under precisely the same conditions as we, except so far as they work under a diametrically opposite system of commercial policy.

MR. H. HIRST seconded the adoption of the report.

A SHAREHOLDER remarked that last year they had a very favourable report of the Hammersmith lamp factory. Was there any reason why they had no such report this time?

The CHAIRMAN: No news is good news. They are getting on very well, making more lamps every day. We are fully employed there, and we hope that very soon all the lamps that are required for this market will be made at Hammersmith. The quality produced there is quite up to any made on the Continent, and the finish is even better.

The report was adopted, the dividend resolution was passed, Mr. Max Railing was re-elected a director and the retiring auditors were re-elected. A vote of thanks was accorded to the chairman in the usual way.

Trafford Power and Light Supply (1902), Ltd.

THE directors' report for the year ending March 31st, 1910, shows that after charging interest on the debenture stock, interest on loans, current expenses, debenture trustees' remuneration, and £2,000 for depreciation, there is a loss for the year of £418, as compared with a loss for the preceding year of £2,516. The general state of trade in the company's area, referred to in the previous year's report, shows little or no improvement, although, due to a few new consumers, the sales in the aggregate have somewhat increased The aggregate amount of the 4½ per cent. debenture stock of the company purchased out of the debenture redemption fund and cancelled, amounts to £9,100, and £2,533 is now in the hands of the debenture trustees for further similar purchases. Pending the issue of the second debentures mentioned in the last report, the company's urgent requirements have been met by loans from Messrs. W. T. Glover & Co., Ltd., the largest shareholders in the company which at the end of the last financial year amounted with accrued interest at 5 per cent. per annum to £18,374, and for which a second debenture for £25,000 has been issued as security. In order to provide for such applications for second debentures as may be received in accordance with the notice accompanying this report, the existing second debenture will be cancelled, and a new series of 6 per cent. second debentures created of a total nominal value of £40,000.

Para Electric Railways and Lighting Co., Ltd.

As stated last week, the directors have announced that the first dividend on the 77,145 ordinary shares of £5 each will be at the rate of 8 per cent. per annum for the half year ending May 31st last, payable on September 1st. Our readers will remember that this company was formed in the year 1905 to purchase the mule tramways and electric lighting business in Para under a concession for a period of 99 years, with the intention of converting the tramways to electric traction and extending the lighting business. An account of the system was given in the ELECTRICAL REVIEW for March 26th, 1909. The following figures show the results for the last two complete financial years:—

Year ending November 30th	1908.	1909.
Gross receipts	£205,311	£225,917
Operating expenses	152,637	120,310
Net earnings	£52,674	£105,607
Fixed charges and London expenses, &c.	36,460	45,017
Surplus	£16,214	£60,590

The first half of the current financial year shows cabled net earnings of £62,360, representing an increase over a similar period in 1909 of £18,253. In past years the second half of the financial year has always shown better returns than the first half, and it is anticipated that the increase will be at least maintained, showing total net earnings for 1910 of £130,000.

Crompton & Co., Ltd.

THE directors report that during the financial year to March 31st last, competition for business has been keener than ever before experienced, and orders have been difficult to obtain. With a view to keeping the company's works employed a considerable amount of business has been taken at works cost, with the result that the out put has only fallen off to a comparatively small extent. It is with much regret that the directors have to report that the gross profit realised on trading has not been sufficient to pay administration and selling expenses, while the completing of a large contract in the East has entailed a heavy charge on the year's accounts. The directors also regret that litigation in connection with an order for pumping plant has involved the company in the special legal expenses shown in the profit and loss account. The loss for the year, after making the usual full provision for depreciation and charging all repairs against revenue, amounts to £20,493, as compared with a profit of £10,051 for the year ending March 31st, 1909. After providing for debenture interest and other charges shown in the net revenue account, and after deducting the balance brought forward from last year, there remains a debit balance on this account of £23,369. The guarantee of the Auxiliary Electric Co. in connection with the earnings of the electric Supply Corporation has now expired, and the final adjustment should shortly be arrived at. The directors have decided to write down the company's holding in the Electric Supply Corporation to £4 per share, taking the necessary amount from the reserve fund for that purpose. The claim under the policy of insurance held by the Auxiliary Co. has been settled on terms which are considered favourable; under the settlement the company's holding in the Electric Supply Corporation has been reduced by 3,000 shares of £5 each, £3,000 has been written off the investment in the Auxiliary Co., and the right of the Insurance Co. to the first £10,000, repayable by the Electric Supply Corporation under the guarantee, reverts to the Auxiliary Co. During the financial year, expenditure on patents and experimental work has been considerably in excess of the average. This increase is in connection with an invention which is likely to prove of great value to the company. All such expenses have been charged against revenue, but a sum of £600, being the purchase price of a patent which it was important that the company should control, has been added to patents account. In view of the continued depression in the electrical manufacturing trade, the directors have taken steps to further reduce expenses, and with that view are arranging to move the headquarters of the sales department to the company's works, which it is estimated will effect considerable economies. Although there appears to be an improvement in the volume of the trade of the country, the slight increase in the demand for electrical machinery has not affected market prices. At the same time, the directors are of opinion that by the exercise of the most rigid economy a margin of profit can be earned, even on the basis of the present low prices. Since the close of the financial year an improvement is noticeable in the value of orders coming from colonial and foreign sources.

Continental.—SWITZERLAND.—La Société Brown, Boveri and Co., of Baden, is declaring a dividend at the rate of 8 per cent. for the last financial year, as compared with 11 per cent. in the preceding 12 months

Chatham and District Light Railways Co.

The directors report that for the half-year ended June 30th, 1910, the revenue was £21,601 and the expenses were £12,704, leaving £8,897, less rent of Rochester Corporation lines (£1,872) and interest on debentures (£1,234), leaving £5,792, plus balance brought forward (£298), making a balance of £6,090, which is to be disposed of as follows:—£2,940 to dividend at the rate of 5 per cent. per annum on the preference shares, £1,060 to dividend at the rate of 2 per cent. per annum on the ordinary shares, £2,090 to revenue new account.

The traffic receipts show an increase of £1,242 over those for the corresponding period of last year, which the directors consider satisfactory. There has also been a saving of £117 in the expenses. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year. The dividends are to be paid on August 5th.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car Mileage.	No. of cars.
Dec. 31st, 1908 ..	14·98	4,357,745	£22,282	1·22	597,393	45
June 30th, 1909 ..	14·98	4,038,327	19,787	1·18	561,758	45
Dec. 31st, 1909 ..	14·98	4,712,205	23,045	1·17	582,637	45
June 30th, 1910 ..	14·98	4,347,656	21,029	1·16	556,218	45

Electrical Construction Co., Ltd.

Mr. Walter S. B. McLaren, M.P., presided on Thursday of last week over the seventeenth annual general meeting of the above company at Winchester House, Old Broad Street.

In moving the adoption of the report, the Chairman said that the accounts, while not so favourable as they anticipated at this time last year, were not unsatisfactory having regard to the conditions which had prevailed. He told them at the last general meeting that volume of business was the crux of the situation, and he was sorry to say that their hopes of maintaining the larger output of last year had not been fulfilled. As stated in the report, however, few orders for large installations were placed during the year. Even orders for extensions had not assumed their former volume, although there were indications that the effect of the introduction of metallic-filament lamps was now passing away, and this, coupled with the general improvement in trade, justified them in expecting a greater demand for electrical machinery during the present year. While, however, they had suffered like the rest of the trade from a diminution in the volume of business, he felt confident that they had not suffered more proportionately than their competitors, and judging from their balance-sheet as compared with theirs he should say they had suffered less. It was a pleasure to be able to assure them that the work they turned out gave complete satisfaction to their customers, many of whom came to them over and over and over again, because they knew that their work was absolutely reliable. They sent machinery to all parts of the world, and had orders from Government Departments under the most severe specifications and tests that could be devised. They did not shrink from these, for they could hold their own against any other manufacturer, both in excellence of design and in perfection of work. They would realise that any diminution in orders was at once reflected in the manufacturing profit, because they could not look for any further reduction of importance in their standing charges. These continued, however, to receive the closest attention, and a moderate saving was effected during the past year, but they could not hope to accomplish much more in that direction without impairing the efficiency of the organisation. Every effort, therefore, was being made to increase the company's output, and if this was accomplished he was convinced, more than ever, of their ability to earn a reasonable dividend upon the ordinary shares. While sympathising with the ordinary shareholders in the absence of a dividend (and those of them on that side of the table were among the greatest sufferers), he must congratulate them upon the strong financial position of the company. They had now no loans of any kind, their realisable assets were many times greater than their current liabilities, and they were in a position to pay prompt cash for all that they bought, and so command the best prices and discounts which prevailed. Moreover, they had been able to redeem on favourable terms £40,000 of their second mortgage debenture stock, and an annual sum of £1,800, hitherto paid as interest, would become available for dividends. The stock would be kept alive for the purpose of re-issue, if required, but the board did not at present foresee any necessity for this. Out of the surplus arising from the redemption, they had placed £10,000 to the credit of general reserve fund, and they had a further substantial amount at the credit of a suspense account for a purpose which he would explain. In the early part of 1908 an action was brought against the company by a German firm for alleged infringement of a patent. The board obtained the advice of one or two leading experts and were advised that there was no subject matter for a patent in the plaintiffs' specification. Being desirous, however, of avoiding litigation, the board entered into negotiations with the plaintiffs for a licence, but as reasonable terms could not be obtained the action was allowed to proceed. After extraordinary delay on the part of the plaintiffs, the case came before Mr. Justice Parker at the end of January of this year, who, he was pleased to say, gave judgment, with costs, in favour of this company. An appeal, however, had been lodged by the plaintiffs, which it was expected would be heard towards the end of this month. Pending the conclusion of this litigation the board had credited a sum to a suspense account out of the surplus on the redemption of their second mortgage debenture stock, which should cover any loss if the decision of Mr. Justice Parker were reversed. The position of other companies in which they were interested had not materially changed since last year. The Electrical Power Storage Co. had increased its profits, but the board of that company deemed it prudent not to distribute a dividend—a decision in which they concurred. The proposed extension of the Madras Tramways had not yet been sanctioned by Government, but a marked improvement had taken place in the net receipts from the existing lines. It would, however, be in the best interests of the shareholders in the tramways to retain the increased earnings in the business, but of the ultimate ability of the undertaking to earn a reasonable return they had no doubt. He could only repeat that no effort had been spared, or would be spared, by the board and the officials to place the company again upon a dividend-paying basis, but those of them who had an intimate knowledge of the electrical industry would, he was sure, recognise that they had been contending with very adverse circumstances and with conditions over which they had had little or no control. With patience and continued confidence on the part of the shareholders, however, he was confident that their efforts would eventually be crowned with success.

Mr. James Gray seconded the motion, and the report was adopted without discussion

National Telephone Co., Ltd.

The directors report that the income accrued in respect of the business of the half-year ended June 30th amounts to £1,677,588, as compared with £1,549,136 for the corresponding period of 1909, being an increase of £128,452. The working expenses amount to £974,757, as compared with £890,798 for the corresponding period of 1909, being an increase of £83,959. The net result for the half-year (after deducting the Post Office royalties amounting to £161,530) is a profit balance of £541,301, as compared with £509,210 for the corresponding period of 1909, being an increase of £32,090. The rentals carried forward for unexpired terms of running contracts amount to £1,482,179, as compared with £1,366,283 at the corresponding period of 1909, being an increase of £115,896. Out of the available balance of £409,094 shown by the net revenue account (No. 3) the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £175,000 to the reserve fund account, and to carry forward the balance of £15,344. The sum of £216,874 has been expended on capital account during the half-year in the erection of 16,286 additional exchange and private stations, and in the construction of underground works.

Prospectus.—*Metalite, Ltd.*—Just at the moment of going to press with the last pages of this issue there reaches us a copy of the prospectus of this company, which is on the point of offering to the public 380,000 shares of £1 each out of a total nominal capital of £500,000. The company has been formed to acquire as going concerns the "British Metalite" lamp and metallic filament manufacturing business in the United Kingdom of the Bryant Trading Syndicate, Ltd., and the business, patents, processes, and goodwill of International Filaments, Ltd. The issued capital of these two concerns aggregates £83,557. The purchase consideration to be paid to the Bryant Trading Syndicate is £135,000 (£60,000 in cash or shares, and £75,000 in shares); that payable to the International Filaments, Ltd., is £85,000 (as to £40,000 in cash or shares and £45,000 in shares). The Metalite, Ltd., is to be a parent company, and among its other objects will be the formation of subsidiary companies. Both companies are stated to have considerable contracts in hand, but the prospectus tells nothing concerning the profits actually earned by them in the past; therefore, it is impossible to tell how extravagant is the estimate of a minimum annual profit of £255,000, which, after deducting 33⅓ per cent. for administration and general expenses, reserves, depreciation, &c., is estimated to leave "a dividend exceeding 30 per centum on the entire capital."

Time is too short for us to enter into the statements in the prospectus as fully as we should desire, but our readers will find an article on page 125 of this issue which tells something of the company's claims, its process and its premises. There are several points, however, which must be named—the capital seems to us to be far too large, the investor must bear in mind that the "British Metalite," good as the results of the tests made at the National Physical Laboratory (which were not in our possession until the prospectus was issued) may show it to be, is not the "only pebble on the beach," that the drawn-wire lamp has taken practical shape, and that the estimate of profits is only an estimate of what is expected when new factories, not yet existing, have been got to work.

The directors of the company are Sir Thomas Brooke-Hitching (chairman), Jacob Atherton, Col. D. A. Kinloch, J. F. A. Rawlinson, and Joseph Metcalfe, "C.E.," (managing director), and two others nominated by the two vendor companies after allotment. The list will open on Monday next, and close on 29th inst.

Metropolitan Railway Co.—The directors, after placing £10,000 to electrical renewal and depreciation fund, recommend a dividend on the ordinary stock for the past half-year at the rate of 1¼ per cent. per annum, carrying forward £6,000. A year ago £5,000 was placed to electrical renewal and depreciation fund, and a dividend at the rate of 1 per cent. was declared, £4,000 being carried forward. The dividend on the surplus land stock is at the rate of 2¾ per cent. per annum, the same as a year ago, and £1,900 is carried forward, as against £1,000 last year.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have declared an interim dividend of 2½ per cent. on the preference and 1¼ per cent. on the ordinary shares.

United River Plate Telephone Co., Ltd.

The twenty-fourth annual ordinary general meeting of the shareholders of the above company was held on Tuesday at Winchester House, Old Broad Street, Sir Irving Courtenay presiding.

The Chairman, in proposing the adoption of the report, said the result of the year's working had been exceedingly satisfactory. The company had made excellent progress during the year, subscribers had increased, revenue had increased, the service had improved and was improving, and by the end of the present year—by which time they expected all their principal exchanges in Buenos Ayres would have been turned over from magneto to common battery working—they were satisfied that their service would compare favourably with that of any European city. The new common battery boards, several of which were now working, had been of the most material assistance, and when the others were completed he thought they would be able to face with equanimity any traffic crisis which migt t arise. These changes, of course, necessitated a great deal of other work before the boards could come into use. For instance, existing overhead installations had to be taken down and new distributors connected to their underground plant; but, as far as possible, all this work had been proceeding contemporaneously, and the present year should see the bulk of it completed. The position was in the beginning of May rendered more difficult by the prevalence of strikes among workmen. He was glad to say their staff had on this, as on previous occasions, been splendidly loyal to them. He might admit quite frankly that the service question had been a difficult one to them in recent years. Like most other large telephone companies, they made their estimates of what the probable increase would be in advance, and, in company with them, they had found that, in spite of all their care, the calculations had erred on the side of modesty. Provision, which a few years ago seemed generous in the extreme, was being found to-day to be quite inadequate to meet modern requirements, and they, with other telephone enterprises, were at the present moment straining every nerve to keep pace with the demand. This, from their point of view, was exceedingly satisfactory, as it showed the great progress that was being made. Further, the Centenary celebrations, bringing as they had done many thousands of visitors into the capital of Argentina, had made the strain in their case exceptionally severe. Great as the strain was—and it would give them an idea of its severity when he informed them that some days the rush of traffic rose to 127 per cent. above normal—their latest advices indicated that they got through without any serious hitch. As showing the progress which the Argentine Republic was making in all directions, they found that the same telephone problems met with in Buenos Ayres had already arisen in other cities, and thus they were engaged in erecting a common battery board with a suitable building in Bahia Blanca, where, as he mentioned last year, they had put part of their plant underground; and as a like provision would require, before very long, to be made in Rosario, they had taken the opportunity, when installing a new sub-exchange in that city, to anticipate the conversion of the main exchange, and this sub-exchange would be on the common battery system. Their exchange in Cordoba had also been growing, and would require reorganisation soon, and as the building there was a very old one and quite unfit for conversion, a new building would be necessary when they put in the new board. They had opened new exchanges in Florencio Varela and Monte Grande, two important and growing suburban towns to the south of Buenos Ayres, and in Maipu on the Dolores Mar del Plata line. He mentioned last year that, in response to strong and influential demands they were making arrangements for constructing a line to Mar del Plata, which had been described as the Brighton of Argentina. As the authorities were anxious that this line should be ready for last season—the season comprised the months of December, January and February when Mar del Plata was at its fullest—their people strained every nerve, and, in spite of many difficulties, they completed this line of about 250 miles in what he should think was record time for such an undertaking. It was opened early in the season, and thereby gave the greatest satisfaction to the authorities and the community. As a piece of work, their people were to be congratulated on it, and he was glad to tell them that the result had more than fulfilled their expectations. In fact, while the season was at its height, it was as much as they could do to cope with the traffic, and a satisfactory aspect of the business was that even during the winter the traffic had been much better than was anticipated. The Azul line, to which reference was made in last year's report, had enabled them to tap an important district in the centre of the Province of Buenos Ayres, and when they were in a position to carry this line right through to Bahia Blanca, as they hoped to do before long, they would have an extension of which any company might be proud. Their private branch exchange business was growing rapidly, and was already a valuable adjunct to their business. During the year they had strengthened several of their older provincial lines, enabling them to withstand the violence of the severe storms which from time to time sweep over parts of the country, besides adding additional junction lines between the more important exchange centres in order to save the time of their customers when calls between one exchange and another were desired. In short, he might say they were doing everything in their power to give a quick and valuable service, and while some of the links in the chain were not yet as perfect as they could wish, the constant increase in their subscribers was evidence that on the whole their customers were satisfied. As most of them were aware, it was their policy, wherever possible, to own the land and buildings in which their exchanges were situated. During the year they had purchased the premises in which they were established in Brandzen and Lujan, in which latter town they also owned a valuable stores deposit. They had been fortunate in securing a most desirable plot of land in Mar del Plata, where their building was rapidly approaching completion. They had also purchased sites in General Belgrano and Bella Vista, as well as a site for the new sub-exchange in Rosario. Suitable buildings for these exchanges were either in course of erection or would form part of the current year's programme. To provide for these various works, it was proposed to make a fresh issue of 40,000 ordinary shares. As before, these shares would be offered to the ordinary shareholders at par. With regard to the accounts, there were only a few items that called for special mention. The share capital had been increased by £150,000, the amount of the issue made in September last. The sundry credit balances were a little more than before, due to the general increase in the volume of the business. The subscriptions paid in advance had increased by £2,700; the reserve fund was increased by the £25,000 added last year, and they proposed to add a further sum of £30,000 for the present year. The reserve fund was growing steadily, and in view of the growth of their business and capital the directors attached great importance to this. From the credit side of the balance-sheet they would see that during the year they had spent £130,530 in capital expenditure. The special replacement account stood at £30,448. Their real estate was up by £16,000, representing new buildings and sites for exchanges, &c. The increase of £13,000 in sundry debtors represented, for the most part, payments made on account of the new boards in transit or in course of erection, and not yet taken over by them from the contractors. The securities were nearly of the same amount as last year, and it would doubtless be a satisfaction to them to know that the market value of these investments was well over the figure in the balance-sheet. The stock of materials had risen considerably, but in connection with their new developments they had naturally to carry large quantities of materials of many and varied descriptions, as in their case they were at so great a distance from their suppliers that they could not afford to run short. Bills receivable and cash at bankers were together some £11,000 better than last year. Coming to the profit and loss account, most of the items were quite normal. There had been a gratifying increase in receipts in the River Plate, and although owing to some of the causes he had already mentioned, viz., the strengthening and renewing of certain of their older trunk lines, the opening of new exchanges, &c., the expenses abroad had also gone up, still the general result was an increase in the net profit for the year of £8,124. As each year had for a long time shown an increase on the increase which occurred in the previous year, this their latest increase would, he was sure, afford them sincere satisfaction. The directors recommended a final dividend of 5 per cent. on the ordinary share capital, making with the interim dividend paid on December 31st last, a return of 8 per cent. for the year.

Mr. George Keith seconded the motion.

Mr. M. Herzheim congratulated the directors upon the results of the past year, and said he believed the shareholders had a satisfactory and progressive investment. With regard to the proposed increase of capital, he felt sure that the new issue would be largely subscribed for, but in any future issues he would like to suggest that it would be a good thing to raise the money by 6 per cent. non-cumulative preference shares, ranking for interest after the existing 5 per cent. preference shares, and in front of the ordinary shares.

The Chairman said that with regard to issuing shares in a different form they could consider the question of non-cumulative preference shares, if they could guarantee that the shareholders would take them. They had had a little experience in regard to preference shares in past years, and they did not find that the shareholders came forth very readily to take them up. He was afraid that the issue of preference shares would not be a financial success, and for the present, at any rate, they intended to stick to ordinary shares. With regard to the displacement fund, it was impossible to say when expenditure on that account would come to an end, but the shareholders might rest satisfied that the board spent no money needlessly.

The report was then adopted.

Following the formal business a special resolution was agreed to, increasing the capital of the company to £1,500,000 by the creation of 100,000 new shares of £5 each.

Direct United States Cable Co., Ltd.

The directors report that the half-year's revenue, after deducting out-payments, amounted to £58,556, as compared with £56,445 for the corresponding period of 1909, showing a difference of £2,111 in favour of the half-year under review. The working and other expenses for the same period, including income-tax, amounted to £25,277, leaving a balance of £33,279 as the net profit, making, with £6,869 brought forward from the previous half-year, a total of £40,138. For the corresponding period of 1909 the working expenses and other payments amounted to £25,036. Three quarterly interim dividends of 4s. each per share, amounting to £36,426, have been declared and paid during the financial year, and a final dividend of 4s. per share is now proposed, together with a bonus of 2s. per share (both free of income-tax), making, with the three interim dividends, 4½ per cent. for the year, being a total distribution of £54,639. After transferring £5,000 to the reserve fund account, the balance of £4,783 on the revenue account is to be carried forward. The reserve fund account has been debited with £3,584 for the cost of cable maintenance, and after being credited with interest on the investments, profit on sale of securities, and amount transferred from revenue, the balance now amounts to £533,024.

Edmundson's Electricity Corporation, Ltd.

THE thirteenth ordinary general meeting of the shareholders of the above company was held on Thursday of last week at Winchester House, Old Broad Street, Mr. P. Debell Tuckett in the chair.

The CHAIRMAN, in proposing the adoption of the report, said that a marked and all-round progress had been made during the past year. The gross trading profit had increased by £2,103, while dividends and interest had increased by £5,129. On the other hand, the expenses were reduced by over £1,000, whilst the Urban Co. guarantee and the loss on working the local authorities' undertakings were respectively reduced by £2,506 and £723, the net result being that, after providing for £1,450 additional debenture interest, they were able to carry to the balance-sheet a profit balance of £10,768, as against £597 a year ago. The directors recommended the addition of this profit to the balance of £14,809 previously carried forward, because, under the terms of the supplemental trust deed of August 13th, 1908, they were precluded from distributing it; and since it thus constituted a reserve provision in its entirety, it seemed unnecessary to allocate any specific portion of it to the purposes of a particular reserve. Those conditions would continue until 1912, when they would again be at liberty to resume dividends, should the position warrant it, and in this connection he might as well repeat what he had previously stated, that before that period arrived they would probably invite their approval of a scheme of capital reduction, which would necessarily involve the absorption of all outstanding reserves. The improved results realised during the past year were eminently satisfactory, and the improvement was fairly general over all the undertakings, Bromley and Scarborough being the only two to show decreased profits, and in the case of Bromley there had been an additional burden of nearly £400 in rates, an item of expenditure over which, unfortunately, they had no control. This general improvement was due in part to the unpleasantly inclement weather of the past year, in part to the lower price of coal, but these favourable influences were largely offset by the temporarily adverse influence of the metallic lamp, so that there was no reason to doubt the substantial character of the progress shown. During the past two years immense efforts had been made to establish and develop the business on a more profitable basis, and it was in no small measure owing to such efforts that they were now realising the improved results which these accounts disclosed. The balance-sheet showed an increased capital expenditure by the various undertakings of £59,247, as against the increase of £52,081 for the previous year, whilst the gross profits were up £12,710, a 10·9 per cent. increase as compared with the 6·2 per cent. increase of £6,833 a year ago. The 7 per cent. lamp increase of the equivalent of 88,935 33-watt lamps, though not quite as large as in the previous year, showed healthy and substantial progress, particularly having regard to the fact that with metallic lamps they required to connect three times the candle-power they formerly did to give them an equivalent connection in watts. Of course a large proportion of the new connections were for power, but so it always had been, and it was far from being an unsatisfactory feature. The output for the year was 17,203,384 units, a 10 per cent. increase as compared with the previous year, the private lighting output having increased 4 per cent., which was satisfactory, considering the extensive use of metallic lamps, while the power output increased 19 per cent. Their output for power was now larger than that for lighting, and it was gratifying to see how successful many of their small undertakings had been in working up a profitable power load. The gross revenue from sale of current increased 6 per cent. from £195,415 to £206,316, the average price per unit for private lighting falling from 4·79d. to 4·77d., and for power from 1·12d. to 1·07d., whilst the total average price per unit fell from 2·99d. to 2·88d. The expenditure, on the other hand, in spite of the increased output of 1½ million units, showed an increase of less than £300, the ratio of expenditure to revenue having fallen from 48 per cent. to 46 per cent., whilst the average total cost per unit fell from 1·63d. to 1·49d. Coal cost over £2,000 less. The results achieved at individual stations were naturally in some cases better, in others worse, than the average, but in no case were they distinctly bad, having regard to the governing conditions. In two of their undertakings the total cost per unit worked out respectively as low as ·68d. and ·72d. In some 15 of their stations the cost of coal was ·4d. per unit or under, being as low as ·23d., ·24d. and ·25d. in three of them, all steam stations. Those results were very creditable in stations as small as theirs. As they were aware, notice had been received from the Winchester Corporation of their intention to purchase the undertaking of the Winchester Co., in which they held £16,815 ordinary share capital and £9,000 debenture capital. Under the terms of the deed of transfer the purchase price was to be the amount of the capital reasonably expended on the undertaking plus 10 per cent. thereon. The exact figure would be determined by arbitration, and would to some extent depend on whether expenditure on free wiring was held to be properly included. He could not, of course, discuss the merits of the question that day, but they might rest assured that the Winchester Co. would take all proper steps to obtain a satisfactory award. Whether they got £1,000 more, or less, did not, however, materially affect the main fact that they were going to exchange an investment yielding an average return of over 5½ per cent. for an addition to their cash resources, of which he hoped they would before very long be able to make equally good use. Their investment in the debentures of the Lancashire Power Construction Co. had now been completed by the payment of the final instalment of £14,000, and, as some of them were inclined to doubt the wisdom of their making the investment, it might interest them to know that there had recently been some inquiry for the debentures at a premium. The company made a small working profit last year, whilst this year, in spite of the adverse conditions still prevailing in the cotton trade, it was making a substantial and increasing profit, which should be sufficient to cover the debenture interest. The corner appeared, therefore, to have been turned, and they certainly hoped to see steady progress maintained. Of the Scarborough Tramways, on the other hand, he regretted to say that he had nothing encouraging to report. A profit of £8 for 1908 had now been converted into a loss of £677 for 1909. The weather conditions were no doubt particularly unfavourable last year, so that it was not unreasonable to hope that somewhat better results might be realised this year, but the revenue had always been very disappointing, whilst the expenditure had steadily and inevitably increased year by year with the increasing need for repairs and renewals, which this last year were nearly £500 in excess of those for the previous year. They were satisfied that the undertaking was being made to yield as much as it was capable of yielding under existing conditions, and it was therefore obvious that it could not continue indefinitely to be run under those conditions. The company had recently approached the Town Council with a view to their relieving it of the burden of maintaining the roadway, and, under the circumstances, he thought it was inexpedient that he should add anything further to what he had already said. With reference to the position and prospects of their undertakings generally, there was every reason to anticipate steady progress, although it would be unreasonable to expect that their rate of progress would be continuously maintained at the same high level as during the past year. As compared with last year there was no longer a saving in the price of coal; the weather also had, on the whole, been a great deal finer, at any rate until the last few weeks, and this and the increased efficiency of the metallic lamp had exerted a marked influence on the output during the earlier months of this year. They hoped, however, that these influences would be merely temporary; for, speaking generally, and subject to any further increase in the efficiency or reduction in the candle-power of the high-voltage lamp, he thought they might consider that they had now very largely felt the effect of its adverse influence, so far as shops and similar class premises were concerned. In private houses, there still remained a wide field for it adoption. In this direction, therefore, they might continue to feel the effect of its adoption for some little time, but inasmuch as its adoption by private residents was likely to be more gradual than in the case of shops, and was, moreover, in most cases equally likely to be accompanied by an increase of candle-power, he saw no reason to anticipate that they would not be able by new connections to more than make good any temporary check which this adverse influence might exert. That the metallic lamp was their very best friend and had established the business on an infinitely stronger foundation than that on which it previously rested, there could be no manner of doubt, and recently there had been distinct indications that it was beginning to stimulate new connections. He need hardly say they were doing all in their power to bring about improved methods and a higher standard of illumination. They were also doing their best to bring to the notice of their consumers the various accessory uses to which they could put their supply with convenience, and in many cases, with economy to themselves. Marked improvements had recently been made in heating, cooking and other electrical apparatus, and as these continued with a corresponding reduction in the price of such apparatus, they hoped it would be possible very considerably to extend their use. Apart, however, from the lighting load, to which his remarks had mainly applied, they must not lose sight of the fact that their power load, besides being entirely unaffected by weather conditions and questions of lamp efficiency, was likely to be benefited by the improved trade conditions to which they were encouraged to look forward. They had, therefore, no anxieties that they would not continue to make steady progress, although it was impossible to forecast the rapidity of that progress, necessarily dependent as it was on so many circumstances beyond their control; but the business having in it the possibilities of development, which he was sure it had, they felt confident that the energy and thoughtful care which were being devoted to its conduct, could not fail to produce satisfactory results. Their contracting profits, in so far as they were dependent on capital expenditure, were likely to show some increase, for during this year and next very considerable capital expenditure would be incurred in connection with the Cornish undertaking of the urban company, owing to the development of a very promising demand for power. Situated as they were, he could wish it had been possible to defer this expenditure, but if the business was ever to be secured, it was necessary for them to accept it when offered. He would like to say a few words on the subject of their private installation department, which he was glad to say had responded to the increased efforts and somewhat more active policy to which he referred last year. Neither the circular and catalogue which they issued a year ago to each of their 2,300 shareholders and debenture-holders, nor the appeal which he addressed to them at last year's meeting, had, so far as they could trace, been productive of a single inquiry. There was, of course, no kind of obligation on them to recommend electric lighting to any of their friends or that company's services in connection therewith; but if they, who were so directly interested in the fortunes of the company, were unwilling even to take the trouble of merely recommending it on the many occasions which, speaking of the shareholders generally, must have presented themselves, then they had only themselves to thank if the profits were not larger than they were. During the year several of his friends had allowed the company to install electric light for them both in London and the country, and in acknowledging the way in which the work was carried out, they had thanked him for bringing home to them the manifold advantages of electric lighting, including its comparative cheapness which they had previously quite failed to realise. This being his experience, he saw no reason why other shareholders should not equally

earn the gratitude of their friends by benefiting the company. All they required to earn increased profits was increased business, and that resulted most surely from personal recommendations.

MR. STANLEY BEETON seconded the motion.

MR. PAXTON said that as an original shareholder, and one of the largest holders in the company, he desired to say that the report was certainly much better than he anticipated. He expected improvement, but not the substantial improvement that had been made, and he thought great credit was due to the board and all the officials for the increased profit shown. He was especially glad to find that the Lancashire Power Co. was holding its head up, for at one time he had his doubts whether it would ever prove successful.

The CHAIRMAN, in reply to questions, said that when the guarantee of the urban company expired they would lose the dividend on their ordinary shares in the company, but against that they would receive interest on the large advances which they had made to the company, and on which hitherto they had not had any interest. An additional ½ per cent. interest would become payable on the debenture stock from April, 1912, and would remain in force so long as any prior lien debenture stock was outstanding. As to the Guernsey company, that was making steady progress. Last year its profits had increased by over £400, and during the coming year he hoped they would show a still larger increase. With reference to Scarborough, they had for a very considerable time recognised that that was far and away the worst undertaking in which they were interested, and it was perfectly obvious that the company could not continue to run indefinitely at a loss as it had been running for some time. It would, however, be very short-sighted policy to sacrifice the whole undertaking, unless they were absolutely satisfied that it was not capable of improvement.

The report was adopted.

The CHAIRMAN then proposed the re-election of Mr. Stanley Beeton as a director. He remarked that it was a real pleasure to make that proposition, for during the past two years that gentleman had thrown himself heart and soul into the work of the company, and on many occasions his business experience and his intimate knowledge of all the conditions which governed the successful conduct of a large electrical undertaking such as Edmundson's had been most invaluable to the board.

MR. A. A. CAMPBELL SWINTON seconded the motion.

MR. PAGE said the board seemed to forget that theirs was a *bonâ fide* trading company. The actual increases obtained last year were from investments, and were not due to any exertions on the part of the directors. They showed a profit of £9,000, whereas six years ago it was £60,000 or £70,000, and as far as he could see, since the present board had been in office, they had taken no action to increase the trade of the company.

The CHAIRMAN said that Mr. Page's remarks were out of order, and were quite uncalled for, and he did not propose to answer them.

The motion was then carried.

Chili Telephone Co., Ltd.

MR. GEORGE KEITH (chairman) presided at the offices, 42, Old Broad Street, E.C., on Thursday, over the twenty-first ordinary general meeting of the above company.

In moving the adoption of the report, the CHAIRMAN said he had again the pleasure of presenting to the shareholders a satisfactory report, which showed that their business in Chile was continuing its general progress. The improvement shown had been due principally to the general commercial activity in the large centres of Santiago and Valparaiso, where the bulk of their business lay, and in a lesser degree to the good harvests and general prosperity in the central and southern agricultural districts. In the districts of Iquique and Senena, little or no progress had been made in consequence of the depressed state of the nitrate and mining industries. The value of the currency in which their revenue was collected remained throughout the year low, and practically steady at an average rate of exchange of 10½d. The result in the currency revenue of Chile showed an increase in the year of 8 per cent., while the working expenditure came out at 50 per cent. of the revenue, and 2 per cent. more than last year. The increase in the rate of working expenses was due to the higher price of materials and to the advancing cost of living, which involved increases in salaries and wages. Turning to the London revenue account, the income in Chile, when converted into sterling, showed an increase for the year of £2,713, and interest on investments and the other cash balances was £453 more. Altogether, the gross revenue amounted to £41,685 or £3,171 more than last year. The balance-sheet showed the company's position to be considerably strengthened by the year's operations. As regarded the company's property in Chile, besides the ordinary extensions due to joining up new subscribers, 19 new offices had been opened in the small towns in the central and southern districts. The trunk lines had also been increased to meet the growing requirements of the inter-town communication. The work of placing the wires at Santiago underground had been very much advanced in the year, and this had greatly relieved the congested overhead wires in the centre of the city. As regarded the present year, the financial situation of Chile was showing some signs of improvement. The exchange had lately been firmer, and now stood at about 11½d. Business generally was good and active. The country generally was progressing, and with it the telephone business was naturally developing. Altogether they might well be satisfied with the business. It was paying a steady and substantial dividend and providing an ample reserve for its own development. This policy had enabled them in the past to free the company of debt by paying off the 6 per cent. debentures, and to maintain the usual dividend in the year of the earthquake disaster. It was now enabling them to meet the expenses they were called upon to incur in putting the wires underground in the City of Santiago. He might mention that the board were considering the advisability of capitalising a part of the reserve fund which had been invested in the business, and distributing it to the shareholders as fully paid-up shares, in order to get the share capital of the company more on a par with the value of the property. This being simply a transfer from the reserve to capital account would in no way affect the working of the business, with the exception that the amount available for dividend would be in future distributed on an increased capital. Should this be decided upon, it would be necessary to increase the nominal capital of the company, and a meeting of the shareholders could be called in due course. In conclusion, the chairman thanked the staff both in Chile and London for their loyal support of the board.

MR. F. W. JONES seconded the motion.

Answering a question, the CHAIRMAN said it was difficult to estimate what the cost of placing the wires underground in Santiago would be, for it was a work which would extend over a good many years. They had not expended very much yet.

A SHAREHOLDER asked how much of the reserve it was intended to capitalise.

The CHAIRMAN said this had not been decided yet.

The SHAREHOLDER said it was usual for telephone companies to have large reserves, and at present the company's reserve was less than its capital.

MR. JONES said he was familiar with telephone companies on both sides of the Atlantic, and he did not know of any company with a reserve equal to its capital. He did not see how that could be done without denuding the shareholders of what ought to be in their pockets.

Several shareholders congratulated the board on the success of the company, and on the proposal to capitalise part of the reserve.

The report was then adopted.

Victoria Falls and Transvaal Power Co., Ltd.

THE annual general meeting of the shareholders of the above company was held on Friday last at Salisbury House, London Wall, the Marquis of Winchester presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 68), said that the share capital of the company on December 31st, 1909, was £2,708,000, of which £1,000,000 was in ordinary shares; £1,702,183 issued preference shares and £5,817 preference shares upon which £965 only had been received and which shares had consequently been forfeited. As, however, the total issue of the preference shares had been guaranteed in full they had not regarded them as unissued capital, as they were re-allotted early this year to the guarantors upon payment by them of the amount outstanding. The first mortgage debentures amounted to £800,000. The subscription of a further £900,000 debentures had been obtained at 94 per cent. since December 31st last. During the present year they had issued those debentures to the Dresdner Bank and the Deutsche Bank, and they had also obtained subscriptions for £130,000 6 per cent. cumulative preference shares, so that the total share and debenture capital at the present time amounted to £4,538,000, made up as to £1,000,000 in ordinary shares, £1,838,000 in 6 per cent. cumulative preference shares, and £1,700,000 in 5 per cent. first mortgage debentures. The new issue of capital had been made in connection with the provision of the share and loan capital of the Rand Mines Power Supply Co., Ltd. The whole of the share capital had been taken up by them, and they would also take up all the loan capital as and when the business of the Power Co. required the advances. Creditors figured at £37,880. This sum represented the contractors' accounts in Europe and South Africa, for contract work certified, but not paid at the date of the balance-sheet, and amounts owing for engineering fees, sundry merchants' accounts, native wages, income-tax, &c., all of which had since been paid. The contractors' retention account, amounting to £40,946, was the amount retained under the agreement with the contractors. A large proportion of this sum had now been released. The balance of revenue over expenditure at the end of the year amounted to £135,397 16s. 7d., which had been carried forward to the current year. There had been a further expenditure during the year of £28,996, in addition to a previous expenditure of £1,663,912 on the purchase of leases, concessions and undertakings. The expenditure on new stations amounted at the end of last year to £1,193,478, and the expenditure for the year under that head amounted to £493,593. The debtors amounting to £21,162 were amounts owing to the company for power supplied, and since paid. Proceeding to deal with the reasons which had induced the board to carry forward the profit, the chairman said that in such a business where customers were limited in number, they had had to accept liabilities to supply all and every one of the mining properties controlled by each of their consumers on the Witwatersrand. They had few customers, but those customers had a large increasing demand for power, and they had had to accept the responsibility of providing same to new contracting, as well as contracting companies. This meant increased capital commitments, which would be met by increasing their debenture issue. If they were to do this they must be able to prove that there was a substantial margin of revenue over and above that required to meet the debenture interest during the present year. He could, by the end of 1910, show that they had accumulated a sum which would secure the interest on a largely increased issue of

debentures, until, by the middle of 1911, their increased plant would be in full commission, and the revenue which they would then be earning would enable them with safety to consider the rights of their shareholders. Their business was secure, but at the moment they were in the position of a new railway undertaking. They had their permanent way well and truly laid, they had traffics awaiting them, but they required the delivery of their rolling stock before they could earn the full revenue which would be the reward for their sacrifice and patience. He did not believe in shareholders being asked to make sacrifices for posterity. He asked them only to remember that their interest was cumulative, and that, although it would have been a much pleasanter task for his colleagues and himself if they had been able to recommend a distribution, they were confident that it was in their interest that they should defer doing so until the new station at Rosherville, which represented such a large proportion of their assets, was in full commission and earning revenue. His colleague, Mr. Birchenough, who, in his absence last year, conducted the business of the meeting, referred to the difficulties and anxieties which had to be faced and overcome in a great business such as theirs, especially during the early years of its career. He confessed that this past year had fully justified the opinion he then expressed. When in Johannesburg last year, he (the speaker) gave evidence before the Power Commission, and he confessed that, when the draft of the Power Undertakings Act of 1910—the outcome of the Commission's Report—reached this country, his anxiety was considerable. The action of the then Minister of Mines, Mr. de Villiers, in sending them a draft of the Bill for consideration, emboldened him to hope that some amendment of certain of the provisions, which were inimical to their interests, could be attained. Time, however, owing to the near approach of the necessarily brief session of the expiring Transvaal Parliament, was of importance. The services of Mr. Vesey Knox, K.C., were secured, and he left England, accompanied by Mr. A. E. Hadley, their managing director, and Mr. Arthur Wright, electrical engineer, on April 19th, and reached Johannesburg on May 7th. He need not trouble them by enumerating the various amendments which were secured; it would be sufficient to say that the Power Undertakings Act of 1910 contained no provisions which were calculated to prevent the carrying on of their business so as to secure for them the return upon their investment which they had a right to anticipate. A business such as theirs was necessarily dependent on the good will of the gold mining industry, and he was glad, therefore, to inform them that not only had further contracts to take power been concluded, but certain of the contracting companies had also become financially interested, as shareholders, in the success of their undertaking. The Driehoek station, from the fact that the plant was not of an economical type, would have been closed down last year, and merely retained as a stand-by, until the installation of the more modern stations were completed, but owing to the increasing demands of the mining industry for power, it was decided to keep this plant in commission. This, although not satisfactory from a revenue point of view, enabled them to give supplies to new consumers, and to consolidate their position in such a way that the future profits on these additional contracts would quickly compensate them for the loss in revenue in the year under review. With regard to their coal contracts, practically all the coal they consumed, or would consume, in the Brakpan, Simmer Pan and Rosherville stations would be drawn from the Middelburg district. Vereeniging, owing to its proximity to the collieries of the Vereeniging Estates, Ltd., as well as the unrivalled water supply of the Vaal River, offered a site for the economical production of power which they had recognised from the outset. Application had been made to the Transvaal Government to enable them to erect a new station there. The new agreement which had been entered into by them with Messrs. Lewis & Marks and the Vereeniging Estates ensured for the company long-term contracts for coal on favourable terms, and the erection of a power station at that point would undoubtedly add considerably to the facilities which existed there, for the establishment of those new industries which the general wealth and resources of South Africa would undoubtedly attract, now that the States of the sub-continent were united under one Government; this should further increase the demands for energy in that immediate neighbourhood. For the successful conduct of their business in South Africa they were again indebted to the energy, foresight and perseverance of their general manager, Major the Honourable Walter L. Bagot, and it had been a cause of much satisfaction to them at home that, as engineer-in-chief, they were able to associate with him Mr. Bernard Price. Mr. Price, besides having a wide knowledge of the transmission of electrical energy at high pressure to mining companies and commercial undertakings gained in the North of England, was possessed of those especial qualities which resulted in obtaining from his subordinates their loyal support and co-operation. Having alluded to the additions to the board, the chairman, in conclusion, said it was now 16 months since they commenced to deliver power from their new station at Brakpan, and 12 months since the first of the Simmer Pan turbines came into commission. They would be glad to be assured that, in spite of criticisms in the columns of certain usually well-informed newspapers, they were satisfied that the difference between the cost at which they had undertaken to supply their mining consumers, and the cost of production, would enable them to carry on their business so as to show a fair commercial return on the capital invested. They had never expected more, nor had they desired to create a monopoly. They had aimed at securing the confidence and goodwill of the mining industry, and by the production and sale of cheap electrical power, to attract additional industries to the Transvaal, and to give the fullest consideration to the coal mining industry by the general distribution of their coal contracts. The Power Commission's report to which attention had been drawn in the columns of the Press in this country had recorded the large saving of capital expenditure to mining companies and the reduction of working costs at the prices at which they had undertaken to supply power in bulk, as against its generation on the individual mines. As an example, the report of the Power Commission stated that the saving of capital in the case of the equipment of the City Deep Mine was £124,000 in favour of purchasing power, or, assuming the monthly capacity to be 65,000 tons, a saving equivalent to £1,900 per 1,000 tons monthly capacity. In works costs the saving was estimated to range from 6d. to 1s. per ton crushed, or, if they took another test:—Cost per unit, steam ·918d., electricity ·525d.; cost per ton crushed, steam 24·7d., electricity 14·2d., or a saving of 10·5d. in favour of electricity. He thought they would require no further evidence than that of the independent and unbiased minds of the Commission, as to the advantages which their consumers derived from the presence of their undertaking in their midst. Whilst he said there was no monopoly, they must from economic reasons, come to them for the supply of the power they required. They had so framed their contracts as to financially interest their consumers in the welfare of the undertaking outside of the interest which certain of them had acquired through the provision of capital. Such a combination must tend to promote, not only the growth, but also the prosperity, of the undertaking in which they had invested their money.

SIR CHARLES METCALFE, in seconding the resolution, said it was not very long ago since he visited the company's works in the Transvaal. What always struck one in connection with South Africa was progress, and that note of progress had been quite marked in the electrical business. By dint of very hard and very anxious work it had been developed from a small business into a great and important industry. For every great industry three vital factors were essential—the *personnel* of the staff, organisation, and the best of machinery. As to the machinery, he thought they might congratulate themselves that it was of the most up-to-date type. He was happy to say that the deliveries by the A.E.G. had all been up to date except the switchgear, which was delayed owing to a strike at the factory. With regard to the staff, he saw most of the members, and was very pleased with their *personnel*. They struck him as energetic, zealous, and very capable. The organisation, which was, of course, not good at first—in these great industries it was difficult to make them good at once—had been constantly and almost daily improved, and they had a most able organiser in Mr. Bernard Price. The cost of working was gradually being reduced as their output increased, and that was very important, because by the end of next year they reckoned that their sales would be three times what they were to-day.

The report was adopted.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors have declared the usual interim dividends upon the 4½ per cent. preference shares and the 6 per cent. second preference shares, less income-tax, for the half-year to June 30th, and an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum, for the half-year ending June 30th. The share transfer books will be closed from July 23rd to August 5th.

James Keith & Blackman Co., Ltd.—The directors report that the amount of business done during the year to March 31st exceeded that of any previous year. They recommend that dividends be declared at the rate of 5½ per cent. per annum on the preference shares, and at the rate of 5 per cent. per annum, free of income-tax, on the ordinary shares, carrying forward £2,389.

British Columbia Electric Railways Co., Ltd.—The directors have declared a dividend at the rate of 5 per cent. per annum on the 5 per cent. non-cumulative preferred ordinary stock for the half-year to June 30th, together with an additional dividend at the rate of 1 per cent. per annum for the same period.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, for the half-year ended June 30th, 1910, and an interim dividend on the ordinary shares for the same period at the rate of 4 per cent. per annum, less income-tax, both payable on August 2nd, 1910.

New General Traction Co., Ltd.—According to the *Financier* the report states that the revenue from the various subcompanies amounted to £19,482, as against £18,701 in the previous year. After providing £376 for the realised loss on certain bonds, and £1,500 towards depreciation, the accounts show a profit of £500, reducing the debit balance to £25,306.

Lisbon Electric Tramways, Ltd.—An interim dividend of 3 per cent. (free of income-tax), on account of earnings of the current year, has been declared.

Egypt.—The report of the Compagnie Egyptienne Thomson-Houston for the last financial year shows a profit of £3,392.

MARKET QUOTATIONS.

Wednesday, July 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£9 10	..
a Copper Sulphate	"	£18	..
a Lead, Nitrate	"	£25	..
a " White Sugar	"	£33 10	..
a " Peroxide	"	£33	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	5½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a " Chlorate	per lb.	3½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	85/-	15/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %) ..	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a " Cyanide (basis 100 %) ..	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	..
b " Wire, in ton lots ..	"	£112	..
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£33 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6¾d.	¼d. dec.
c " Tube (brazed)	"	8¼d.	¼d. dec.
c " " (solid drawn) ..	"	6¾d.	¼d. dec.
c " Wire, basis	"	6¼d.	¼d. dec.
c Copper Tubes (brazed)	"	8¾d.	¼d. dec.
c " " (solid drawn ..	"	8d.	¼d. dec.
g " Bars (best selected) ..	per ton	£68	£1 dec.
g " Sheet	"	£68	£1 dec.
g " Rod	"	£68	£1 dec.
e " (Electrolytic) Bars ..	"	£57 15	..
e " " Sheets ..	"	£74	..
e " " Rod ..	"	£62 10	..
e " " H.C. Wire	per lb.	7.5 d.	..
f Ebonite Rod	"	6/-	..
f " Sheet	"	5/6	..
n German Silver Wire	"	1/6	..
h Gutta-percha, fine..	"	..	..
h India-rubber, Para fine	"	10/2	..
l Iron Pig (Cleveland warrants) ..	per ton	49/-	11½d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£12 15 to £13	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 15	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d " " " medium	"	2/6 to 4/-	..
d " " " large ..	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/1½	1½d. dec.
p " " rolled strip & sheet	"	1/2	1d. dec.
o Platinum	per oz.	..	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£147 to £148	£1 dec.
n " Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£26 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Grindell-Matthews Wireless Telephone Syndicate, Ltd.—According to the financial Press, Sir J. C. Robinson presided at the statutory meeting of this syndicate, held last week. He said that representatives of several public bodies had been over from the Continent for the purpose of having the advantages of the telephone explained to them, and these experts had expressed themselves as perfectly satisfied. "The directors, had, however, made it a *sine qua non* to the acquirement of any foreign rights that the purchasers should take up shares in the parent syndicate. Works had been erected at Pilning, on the Bristol Channel, and Mr. Grindell-Matthews was engaged there with his assistants in experiments which would produce, it was hoped, an apparatus which would be the last word in wireless telephony. He believed not many weeks would pass before it would be possible to give shareholders some gratifying information under this head."

Anglo-American Telegraph Co., Ltd.—The directors have resolved, after placing £5,000 to the credit of the renewal fund, to declafe an interim dividend for the quarter ending June 30th, 1910, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on July 30th. A balance of £18,297 will remain to be carried forward.

STOCKS AND SHARES.

Tuesday Afternoon.

THE change in the weather last week had a sentimental effect upon the Stock Exchange markets, and Home Rails were not the only stocks to improve, although they had most reason to, since the holiday traffics can hardly fail to be helped by the sunshine. Money is plentiful, but not so cheap as to rekindle much optimism in regard to a possible change in the Bank Rate on Thursday, on which point opinion leans to the side of no change.

It has to be admitted that the first of the Home Railway dividends—that of the City and South London—affords grounds for a good deal of disappointment, nor is the sentiment greatly mitigated by the report and accounts. A reduction at the rate of ½ per cent. is considerably worse than had been looked for, but the price has not receded more than a point. The report shows how expenses display an uncomfortable tendency to creep up, and draws attention to the loss of traffic, direct and indirect, caused by the death of King Edward. Moreover, the competition of the Brighton Railway's newly-electrified section has to be added to that of the tramways. Neither of these, it need hardly be said, is at all likely to wane in the immediate future.

Central Londons are the turn easier, partly by reason of the City and South London's statement. The latter, however, mentions that the work of making a subway at the Bank Station between the Central London and the City and South London is in hand, and this should prove a valuable investment to both companies. The Central London, of course, is about to construct an extension to Liverpool Street, and provided the cost does not prove beyond the figures already suggested, the "Twopenny Tube," as we suppose it will always be called, ought to start upon a fresh lease of greater prosperity than has distinguished it of recent years.

There is a wild rumour to the effect that the South-Eastern has a design for tunneling the Thames between Cannon Street and Waterloo, and thus tapping the South-Western traffic by a Tube instead of by its present overhead service. In view of the South-Eastern finances, and other reasons, the rumour rings like a piece of pretty invention. On the other hand, in view of the success of the Brighton Railway's electric experiment, it seems at least possible that other trunk lines may branch out in a similar manner sooner or later.

Metropolitan Consolidated stock receded on the dividend, but Districts are unchanged. The Metropolitan District has got its Bill passed by a Select Committee of the House of Commons, and its dispute with the Great Western over the construction of a new station at Goldhawk Road has been settled by a compromise under which the latter company has the option for five years of making a station of its own in the same street.

The Metropolitan dividend, at the rate of 1¼ per cent., with a carry-forward of £6,000 and £10,000 placed to renewal and depreciation, was another disappointment to the market, sending the price back to 40.

The Edmundson's meeting, at which very little definite information for reducing the capital was vouchsafed, led to practically no movement in the prices. As a whole, the market for electricity supply shares is quiet as ever. A slight rise in "City Lights" is the only change worth noticing. The Mexican Light and Power Tramways and Rio Trams Ordinary shares are all *ex* dividend. An interim dividend at the rate of 5 per cent. is declared on Bournemouth and Poole Ordinary, and the accounts for the next half are expected to reflect the benefit derived from the recent carnival and aviation meeting, so sadly marred by the fatal accident. Lisbon Electric Tramways announces an interim dividend of 3 per cent.

Anglo-American Telegraph stocks have been a lively market again. The Deferred spurted 2 points, rising to 26¼, but rattled back to 25¼ on the dividend declaration last Friday, a rally occurring again afterwards. It will, of course, be six months before any distribution accrues to the Deferred, but the amount carried forward to the credit of the stock, after payment of the usual 15s. and 30s. to the Ordinary and Preferred respectively, is no more than £18,297, and the market prophets talked of £20,000 at least. Direct United States shares continue dull. Amongst the other issues marked *ex* dividend at the Stock Exchange settlement last week, Eastern Telegraph Ordinary went *ex* 1¼, Eastern Extensions 2s. 6d. and Telegraph Constructions 12s.

The brief Wireless Telegraphy Act, influentially backed, is now published, its object being to secure that all ocean-going vessels shall be equipped with wireless telegraphy apparatus. Marconi shareholders will watch its progress with even keener interest than the proprietors of steam and other shipping shares. Marconis keep about 15s. Telephone descriptions are very quiet, and business in Nationals has rather fallen off.

Anglo-Argentine Tramways First Preference are easier. British Electric Tractions are a dull market. The only traction issues which display activity just now are those of the London General Omnibus Company, for which there is a little inquiry. London United Tramways Preference are no better. The Electric Traction Company of Hong-Kong is writing 15s. a share off its capital, which will thus be reduced to £81,250, which cannot receive any dividend in respect of the two years ending December 31st, 1911. An additional issue of £10,000 Debentures—not £30,000, as originally proposed—has been decided upon.

Miscellaneous shares are quiet, and little changed. Babcock hold their improvement. The rubber share market is firm, but there is not much doing for the present.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations July 12th.	Closing Quotations July 17th.	Business done week ended July 17th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3¼	3⅜ — 3¼	72/6	68/9	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,609 Red.	100	5 %	5 %	5 %	5 %	100¼—102¼ xd	100¼—102¼ xd	..	..	..	4 17 7
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	136 —138	136 —138	..	..	..	5 15 11
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	91 — 93	91 — 93	93⅞	..	..	4 6 0
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3½%	63 — 65	64 — 66	64½	..	+1	5 9 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106 —108	106½—108½	107¼	107	+ ½	5 10 7
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	24 — 24½	25⅛—25⅜	26 1/16	24½	+1¼	6 15 11
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 5/16— 8 7/16	8⅜— 9¼	9	8⅜	+ ⅛	4 6 6
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 86	83 — 85	85⅜	84½	—1	4 14 2
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8½ — 9	8½ — 9	..	..	..	6 18 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16¼ — 17½	16¼ — 17½	..	..	— ¼	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3¼ — 3⅜	3¼ — 3⅜	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
60,710‡	Direct United States Cable	20	4⅝%	4½%	4½%	4 %	14½ — 15	14¼— 15	14⅝	14⅜	..	5 6 8
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	133 —136	132 —135 xd	134	132	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	83 — 85 xd	84⅜	83¼	..	4 2 4
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	101½— 103½	102 —104	102⅛	..	+ ⅛	3 16 11
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅝— 12⅞ xd	12⅝ — 12⅞ xd	12⅝	12⅜	..	5 8 9
752,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	..	..	3 17 8
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5⅞%	5⅞%	5⅞%	10½— 10⅞	10½— 10⅞	10 5/16	10 1/16	..	5 10 3
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	12¼— 13⅜	12¼— 13⅜	13⅛	..	..	4 9 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30½— 31½	30 — 31	30⅝	30	— ¼	6 4 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	54⅞	54	..	6 15 8
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	88 — 92	86 — 90	88⅝	..	—2	4 14 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 81	76 — 80	..	..	—1	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	— 1/16	6 3 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108	106½—108	107⅞	107	..	5 11 1
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	127 —129	126¼—128¼	128	126⅞	— ½	4 13 5
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10 7/8	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10⅛— 10⅞	10⅛— 10⅞	10⅛	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16— 5 1/8	5 1/16— 5 1/8	..	..	..	4 7 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96 — 98	97⅛	..	..	3 11 5
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	98 —100	98 —100	99⅛	99	..	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1 7/16— 1 11/16	1 7/16— 1 11/16	..	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅛ — 8	7⅛ — 8	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	128 —131	128 —131	..	..	..	4 11 7
140,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7⅞— 7 7/8	7⅞— 7⅞	7⅞	7 7/8	+ ⅛	5 4 11
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 1/16— 5 3/16	5 1/16— 5 3/16	5⅛	5 1/16	..	4 15 8
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅜— 14½	13⅜— 14½	14 1/16	13⅜	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ¾	⅜— ¾	13/9	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8¾ — 9	8¾ — 9	..	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —101xd	99 —101	..	..	..	4 19 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4⅜— 4⅝	4 5/16— 4 7/16	90/-	87/6	— 1/16	5 9 7
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4¼— 4⅜	4 3/16— 4 7/16	..	..	— 1/16	5 12 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	89 — 90½	90 — 91½	90¾	89½	+1	4 7 5
932,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	104	..	..	4 15 3
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	20 %	24 %	5⅛— 5⅜	5⅛— 5⅜	5⅜	5 1/16	— ⅛	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	3 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	141 —146	141 —146	142½	..	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	124 —128	124 —128	126⅝	126	..	4 13 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —113	108 —110xd	112½	109½	..	4 10 11
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	100 —103xd	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	½— 1½	½— 1	15/-	..	— ¼	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1¼%	Nil	2½— 3	2⅝— 3⅛	57/6	55/-	+ ⅛	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	88 — 92	87 — 91	89½	89	—1	5 9 11
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 73	68 — 73	68⅝	..	..	6 3 3
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6½ — 7	6½ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞— 6⅛	5⅞— 6⅛	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	5/16— 9/16	5/16— 9/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 61	59 — 61	..	..	..	6 11 2
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16— 1/8	1/16— 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	16 13 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4⅛— 4⅜	4 — 4⅛	..	..	— ⅛	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,380..	5	5 %	5 %	5 %	5 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 1 3
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	97/6	..	..	4 10 11
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9¼— 10¼	9¼— 10¼	9⅜	..	..	4 17 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅞— 5¼	4⅞— 5¼	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2⅜— 2⅝	2⅜— 2⅝	54/3	53/-	..	4 10 11
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	106 —109	106 —109	..	..	..	4 2 9
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	66 — 68	66 — 68	67½	65½	..	4 8 3
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 12
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	49 — 51	49 — 51	..	..	..	3 18 5
1,480,000	City and South London Railway	Stock	2⅜%	2½%	1½%	1⅜%	30 — 31	28 — 29	30½	28	—2	6 0 8
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	½— ¾	½— ¾	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	84— 87	84 — 87	..	..	..	5 14 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations July 12th.	Closing Quotations July 18th.	Business done week ended July 18th, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1¼ — 1⅜	1¼ — 1⅜	..	..	..	5 1 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	2½ %	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½ %	2½ %	Nil	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	8 12 4
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	⅜ %	Nil	Nil	⅜ — 1	⅜ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10¼ — 10⅜	10½ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	11⅞ — 12⅛	11⅞ — 12⅛	..	..	..	6 3 8
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 5 9
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½ %	4½ %	4½ %	4½ %	103½—105½	103½—105½	..	..	..	4 5 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15½	14½ — 15½	15	14½	— ½	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	⅜	Nil	Nil	15/16 — 1 15/16	1 — 1	..	..	+ 1/16	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	9 1 10
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1¼ — 2⅛	1¼ — 2⅛	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1¼ — 2⅛	1¼ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜ %	..	2 — 2⅛	2 — 2⅛	..	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	66 — 70	67 — 71	69½	68½	+1	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	⅜ %	⅜ %	1 %	40 — 40½	39½ — 39¾	40 3/8	39⅜	— ⅜	2 10 4
2,640,914	Do. Surplus Lands	100	2¾ %	2¾ %	2¾ %	2¾ %	66 — 68	66 — 68	67½	66	..	4 0 11
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	21½—22	21½ — 22	21⅝	21⅜	..	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½ %	..	3/32 — 5/32	3/32 — 5/32	13/6	..	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/32 — 3/32	1/32 — 3/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/32 — 3/32	1/32 — 3/32	16/3	16/-	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	124 —126	122½—124½ xd	123½	..	..	4 16 5
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	97½—98½	97½— 98½	98⅝	97⅜	..	5 2 0
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/32 — 3/32	1/32 — 3/32	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/32 — 3/32	1/32 — 3/32	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	33½ — 35½	33 — 35 xd	..	..	..	5 19 8
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	101¼—102½	101½—102⅝	102⅝	..	..	4 17 7
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	86 — 88	86 — 88	87⅛	..	..	5 2 3
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	35 — 37	34 — 36	..	..	—1	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/32 — 3/32	1/32 — 3/32	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1¼ — 1½	1¼ — 1½	..	..	..	8 11 5
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7¼— 7⅜	7¼— 7⅜	7 5/16	7⅛	..	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3¾ — 4	3¾ — 4	..	..	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	77/6	75/-	+ ⅛	4 16 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	91/3	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98	97 — 99	72/6	..	+1	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	99	98	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	83/1½	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅛ — 11⅝	11⅜ — 11⅞	12½	12½	+ ⅛	5 17 11
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅞ — 12⅛	11⅞ — 12⅛	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99½—102½	..	..	+ ½	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3½	2⅜ — 3½	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½ — 96½	94½ — 96½	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 8	7½ — 8	7⅞	7⅝	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11½	10½ — 11½	10 3/16	10¼	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103½—106½	103½—106½	105¼	..	..	4 4 6
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	100¾	100½	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1/32 — 1½	1/32 — 1½	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	76 — 79	74 — 77 xd	..	..	..	5 7 2
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	85 — 88	85 — 88	86¾	86½	..	5 8 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝	4½ — 4⅝	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7½	7 — 7½	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7½	7 — 7⅞	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96⅝	..	..	..	4 2 11
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5 — 5½	5 — 5½	5 5/32	..	..	5 14 3
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 92	90 — 92	92	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3⅜ — 3⅞	3½ — 3⅝	..	..	— ⅛	6 13 4
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	104½	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	84½ — 85½	84½ — 85⅞	85¼	85⅛	+ ⅛	5 16 7
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	78 — 80	77 — 79 xd	79¼	77½	..	5 1 3
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	101 —103	101½—103½	103¼	102	+ ⅛	6 15 3
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93 — 94	93½— 94½	94½	93⅝	+ ⅛	5 5 6
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 97	95⅝ — 97⅝	..	..	+ ⅛	4 12 4
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	2 17 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6½ — 7	6½ — 7	..	..	..	5 0 0
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	2⅞ — 2 5/16	210— 225	..	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	1⅝ — 1 15/16	105— 115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8¼ — 8⅝	8¼ — 8⅝	..	..	..	5 15 11
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 14 11
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅜ — 3½	2⅜ — 3½	..	..	..	6 9 0
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	101	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅜ — ½	⅜ — ½	..	..	..	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	..	..	..	6 4 5
224,530	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	¾ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/32 — 5/32	3/32 — 5/32	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅝ — 8¾	8⅝ — 8¾	..	..	..	5 12 8
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	4⅞ — 5⅛ xd	..	..	..	5 1 5

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. June 9th, 1910.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1910.

THE June returns of electrical business show little movement as compared with the preceding month; the exports, which amounted to £313,944 in value, were less than £200 in excess of the May total; the imports totalled £174,561 as compared with £176,175 in the previous month, and the re-exports reached £21,336 or some £1,000 in excess of the May total.

As compared with the preceding month, the export section contains a larger total of general business (£283,881), the machinery sections reaching approximately £150,000 in value.

The importation of lamps shows a falling-off of some £10,000 as compared with the May figures, but a considerable increase in cable imports occurred.

In the re-export total of £21,336 is included some £5,823 "through trade."

Our most prominent customers during the month were the South African Colonies, although South America, India, Japan, and our Australian and Canadian dependencies were also well represented.

Germany was, as usual, the most prominent importing country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	806	4,810	42	59	32	1,560	256	90	...	153	1,672	9,480
Germany	179	...	55	407	782	1,293	10	6	...	66	120	2,918
Netherlands and Java	282	941	28	79	65	549	...	9	...	7	8,310	10,270
Belgium	155	3,392	5	70	345	1,036	12	24	...	892	...	5,931
France, French Indo-China and West Indies...	737	...	258	...	...	3,174	127	120	...	13	109	4,538
Portugal	43	...	...	37	...	29	112	...	...	52	423	696
Spain and Canary Isles...	138	42	388	...	50	1,161	914	39	10	109	14	2,865
Switzerland, Italy and Austria-Hungary ...	24	28	66	...	1,375	1,681	123	...	...	...	30	3,327
Greece and Turkey	144	29	4	97	...	433	190	25	...	31	36	989
Channel Isles, Gibraltar, Malta and Cyprus...	155	34	59	393	36	497	...	11	61	32	297	1,575
U.S.A., Philippines and Cuba	288	...	...	24	63	150	...	281	122	...	686	1,614
Canada and Newfoundland	220	1,341	158	1,191	501	8,149	23	252	87	331	669	12,922
British West Indies and British Guiana ...	103	117	2	116	...	108	...	...	11	19	5	481
Mexico, Colombia, Venezuela, Ecuador and Central America	8	896	...	44	...	489	...	36	...	816	354	2,643
Peru and Uruguay	94	209	...	210	13	576	...	3	...	143	288	1,536
Chile	40	713	55	572	415	681	54	30	...	172	...	2,432
Brazil	339	3,371	175	707	460	5,874	9,151	36	30	6,538	2,807	29,488
Argentine	1,784	7,095	239	1,121	337	4,821	...	316	10	4,009	120	19,852
Egypt, Tunis and Morocco	247	32	24	73	18	865	40	50	...	148	487	1,984
British West Africa and St. Helena	3	585	19	...	13	44	...	...	...	212	228	1,104
Cape of Good Hope	900	1,912	197	339	72	4,300	541	461	30	6	770	9,528
Natal	1,383	10,082	145	478	78	19,295	2,815	81	24	...	1,292	35,673
Rhodesia, O.R.C. and Transvaal	1,206	2,518	550	1,173	37	26,283	...	208	50	321	519	32,865
Zanzibar, Brit. East Africa, Mauritius & Aden	37	149	...	209	...	58	...	2	...	6	359	820
Maderia, Port. East and West Africa... ...	9	258	13	...	...	2,354	574	1,189	...	...	127	4,524
China and Siam	1,284	456	34	234	127	1,092	1,055	21	77	136	52	4,568
Japan	1,198	1,137	603	...	534	10,947	1,115	13	47	1,472	9,097	26,163
India	1,099	3,621	2,113	2,140	618	12,432	2,617	2,059	292	1,141	683	28,815
Ceylon	1,643	656	165	155	93	618	22	160	...	60	58	3,630
Straits Settlements, Federated Malay States and British North Borneo	236	761	79	185	33	1,370	186	149	...	261	8	3,268
Hong Kong	62	105	...	239	10	296	873	114	128	...	16	1,843
West Australia	533	24	230	278	...	1,692	...	169	...	8	...	2,934
South Australia	412	142	141	27	...	905	10	216	...	241	...	2,094
Victoria	1,078	6,011	71	960	54	4,061	185	79	93	250	...	12,842
New South Wales	1,552	4,293	313	1,204	1,770	9,051	515	225	81	903	49	19,956
Queensland	76	...	21	345	...	199	...	929	10	300	364	2,244
Tasmania...	49	...	...	...	...	77	...	3	44	113	...	286
New Zealand	640	1,999	444	598	275	960	36	109	14	157	...	5,232
Total, £	19,186	57,759	6,696	13,764	7,906	129,160	21,556	7,515	1,221	19,118	30,049	313,930

Additional exports: Liberia, telegraph apparatus, £14.

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark	...	3	14	94	...	1,497	425	453	...	6,052	8,538
Germany	986	28,060	1,356	37,446	1,289	25,672	291	541	5,298	9,767	110,706
Netherlands	...	95	4	1,352	...	1,024	50	...	...	...	2,525
Belgium	983	204	7	21	275	4,846	432	90	351	5,102	12,311
France	103	135	736	2,383	685	149	...	1,510	2,974	4,252	12,927
Switzerland	66	420	...	174	24	709	12	13	36	6	1,460
Italy	31	2,712	...	60	...	...	...	...	...	795	3,598
Austria-Hungary	12	342	...	5,029	6	...	...	8	1,596	...	6,993
Canada	...	...	...	50	...	47	...	...	...	...	97
United States	4,258	100	395	717	...	6,559	2,244	708	108	262	15,351
Total, £	6,439	32,071	2,512	47,326	2,279	40,503	3,454	3,323	10,363	26,236	174,506

Additional imports: Spain, carbons, £55.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	3,850	2,817	...	3,799	...	2,638	...	231	475	7,526	...

TOTAL EXPORTS: £313,944. TOTAL RE-EXPORTS: £21,336. TOTAL IMPORTS: £174,561.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns

PRACTICAL NOTES ON ILLUMINATION BY COOPER-HEWITT MERCURY LAMPS.

BY L. CROUCH.

(*Concluded from page* 115.)

Installation Notes. — Attached are various notes, derived from actual experience, concerning the usual height of suspension of mercury lamps, floor area lighted per lamp, maximum, minimum and mean illuminations desirable, and so on. The inherently uniform polar light distribution curve of tubular mercury-lamps greatly simplifies installation estimates and facilitates the obtaining of a uniform illumination. In situations where there is an overhead diffusing surface, such as a white ceiling, reasonably near, it is common to use no reflector with mercury lamps. In machine shops, foundries, open spaces, &c., any upward-passing rays would be wasted, hence it is usual to fit a narrow, flat enamelled metal plate above the tubular portion of the lamp in such cases. This device is simple, cheap and effective.

In the following notes concerning the predetermination of illumination it is assumed :

(*a*) That the space to be lighted can be divided into a number of circular patches or into rectangular areas of approximately square form ; over the centres of these spaces the lamps are assumed to be hung.

(*b*) That the space to be illuminated is so large that wall reflection does not appreciably affect the problem ; this assumption is fairly reasonable in large machine-shops, foundries, &c. The illumination of a small room or corridor cannot be satisfactorily determined by calculation.

The illuminations stated below are those due to single lamps placed at the heights stated and at the centres of areas of the size stated. Under the conditions assumed above, a number of lamps will be required to illuminate the total space, hence the minimum illumination will be approximately $2\frac{1}{2}$ × that due to one lamp alone, while the maximum illumination will not be much greater than is due to the single lamp above the centre of each illuminating section. The effect of other lamps on the mean illumination over the area apportioned to any particular lamp will not be great ; its percentage value will vary with the distance apart of the lamps, and to neglect it will somewhat compensate for the shadow and similar effects which will actually exist in practice.

Where lamps are placed at a horizontal pitch great in comparison with their height above the floor-level, the mean illumination over a given illuminating section is little affected by lamps other than the one apportioned to this area. If, however, the pitch is relatively small, it may be taken, as sufficiently accurate for practical purposes, that the mean

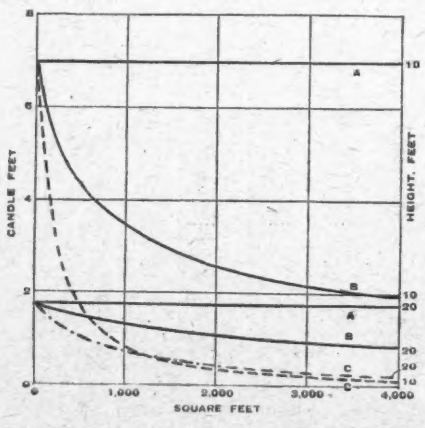


FIG. 1.

illumination equals the arithmetical average of the maximum illumination and the mean illumination due to a single lamp (determined as below). Obviously, calculation would never be employed to determine the illumination of areas in cases where great accuracy was required. Experimental measurements alone are able to give scientific accuracy in this connection, it being impracticable to allow, by calculation, for all the variables influencing the result. Such methods and

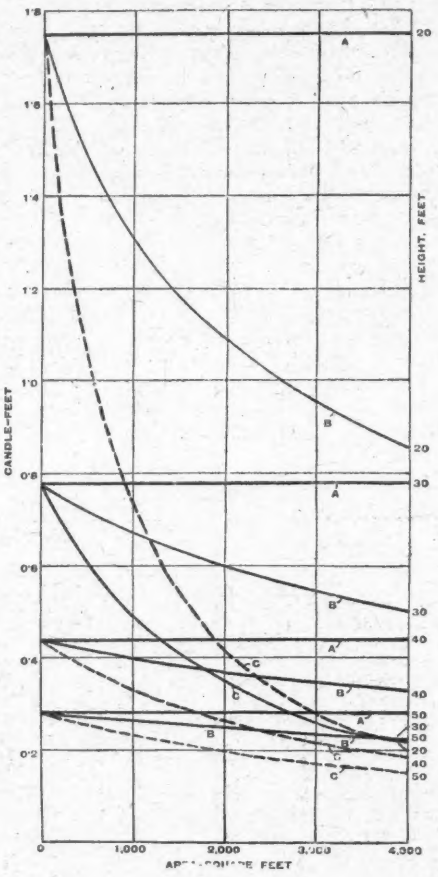


FIG. 2.

formulæ as are subjoined are sufficiently accurate for genera estimating and designing purposes, and are very convenient for this purpose.

Let h represent the height of any lamp above the area which it illuminates (in feet).

Let r represent the horizontal distance (feet) from the lamp to any point A in the area at which the illumination is to be calculated.

Let C.P. represent the candle-power of the lamp (which, in this case, is sensibly constant in all directions), and

Let I represent the illumination, in candle-feet, at the point A.

$$\text{Then } I_A = \frac{\text{C.P.} \times h}{(r^2 + h^2)^{\frac{3}{2}}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

and the maximum illumination of the area, vertically below the lamp,

$$= I_{max.} = \frac{\text{C.P.}}{h^2} \text{ candle-feet} \ldots \quad \ldots \quad \ldots \quad (2)$$

Under the assumptions made above, and as being sufficiently accurate for practical purposes, it is assumed that the area lighted by each lamp is circular in form, so that, if r be the radius of this equivalent circular area, the minimum illumination, due to a single lamp at the centre of the area at a height of h feet, is—

$$I_{min.} = \frac{\text{C.P.} \times h}{(r^2 + h^2)^{\frac{3}{2}}} \text{ candle-feet} \quad \ldots \quad \ldots \quad (3)$$

and the *mean* illumination over the area is—

$$I_{mean} = \frac{\text{C.P.}}{h(r^2 + h^2)^{\frac{1}{2}}} \text{ candle-feet} \ldots \quad \ldots \quad (4)$$

The curves of figs. 1 and 2 are based on these results, and show the maximum, the minimum and the mean illuminations (curves A, B, C respectively) obtainable over various areas by the use of one 700-C.P. mercury lamp placed cen-

trally therein and at various heights above the floor-level, and under the above general conditions. These curves enable, either directly or by simple interpolation, a rapid approximate estimate of the number of lamps required to meet stated needs, or, conversely, of the illumination probable from any proposed or existent arrangement. The curves fully cover the usual practical range of heights of suspension and floor area allowed per candle-power.

Usual Heights of Suspension, Area per Lamp, and Illumination obtained in Mercury-Lamp Installations.—The *heights of suspension* of mercury lamps vary from 10 ft. above the plane to be illuminated to 50, or even 60 ft. in extreme cases (for interior lighting). For exterior lighting, from 25 to 30 ft. is a very suitable height of suspension. It is not usual to hang mercury lamps so high as 50 ft. for interior lighting; an average height, determined from 20-30 actual installations, is from 20 to 25 ft.

The *area lighted* per 600-700-C.P. lamp similarly varies from 700 up to 3,500 sq. ft., an average value for general interior illumination being 1,600 ft. It will be seen that these allowances amount to an average area of about $2\frac{1}{3}$ sq. ft. per C.P., assuming 700-C.P. units slung $23\frac{1}{2}$ ft. above floor level.

The maximum, mean and minimum illuminations (in candle-feet) to which the above conditions correspond are shown in Table V, these figures referring to a single lamp, as above explained.

TABLE V.

—	C.P.	Area lighted. Sq. ft.	Height of suspension. Ft.	Mean illumination. Candle-ft.
Machine and similar shops	700	1,100	15	1·95
Foundries, &c. ...	700	2,100	28	0·656
Average (interiors)	600	1,600	23	0·810
Particular cases (A)	700	1,740	56	0·207
,, (B)	350	420	11	1·99
,, (C)	700	3,040	22	0·838
,, (D)	350	375	12	1·80
Average	300	423	12·3	1·68
,, ...	600	1,860	30·0	0·604
Average per C.P. ...	for 300 C.P. units	1·21	*12·3*	**0·0066*
,, ,, ...	,, 600 ,,	2·66	*30·0*	*0·0011*
,, ,, ...	,, all above	2·37	*23·5*	*0·0018*

* The italicised figures are included to show that the mean illumination in a given installation does *not* equal the mean illumination produced by 1 C.P. suspended at the same height and illuminating an area = mean area per C.P. of the actual installation. This should, of course, be obvious without demonstration, but the author has found uncertainty to exist on the point.

The *candle-feet of illumination* usual in mercury lamp installations varies from $\frac{1}{2}$ to 2 or 3 candle-feet in forges and machine shops (or similar services) respectively. The average value for interior illumination is about $1\frac{1}{2}$ candle-feet. The maximum and minimum illuminations in the above three cases are :—

	Forges, &c.	Machine shops, &c.	Average interior.	
Maxima	1·0	3·0	2·0	candle-feet.
Minima	0·3	1·5	0·75	

It is a fact, which at first sight appears peculiar, that the illumination is usually from two to five times as great in installations employing 300—350-C.P. lamps as in those in which 600—700-C.P. units are employed. This seeming paradox is, however, quite in accord with the general principles of illuminating engineering. In those cases where high illumination is desired, a large number of relatively small C.P. units are employed, placed as close together as may be necessary and low-slung. In instances requiring lower illumination, a few high candle-power units are suspended at a much greater height and at a greater pitch lamp to lamp. A very uniform illumination of the desired lower intensity is thus obtained.

Thus—suspending 700 and 350-C.P. lamps at 30 and $12\frac{1}{2}$ ft. above the floor-level respectively, and allowing $2\frac{2}{3}$ sq. ft. per C.P. for the 700-C.P. lamps, and $1\frac{1}{4}$ sq. ft. per C.P. for the 350-C.P. lamps — the respective mean illuminations are 0·60 candle-feet and 1·70 candle-feet (ratio, approximately 1 : 3), but the variation in illumination is considerably less in the case of the higher candle-power lamp. Thus, for the 700-C.P. unit—

$$I_{min.} : I_{max.} = 0{\cdot}365 : 0{\cdot}779 = 1 : 2{\cdot}14,$$

whereas, for the 350-C.P. unit—

$$I_{min.} : I_{max.} = 0{\cdot}888 : 2{\cdot}310 = 1 : 2{\cdot}61,$$

which example perfectly illustrates the remarks made in the preceding paragraph.

The above notes review, as briefly as possible, the chief problems connected with the installation and use of mercury vapour lamps. Such a review naturally involves the inclusion of a certain amount of general matter. In the present case this contains several new methods of treatment, and forms not the least valuable portion of an article which the author believes will be of considerable interest and value to his readers.

PROCEEDINGS OF INSTITUTIONS.

The Progress of Electric Braking on the Glasgow Corporation Tramway System.

By A. GERRARD, A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS *at London, April 7th, and Glasgow, April 12th*, 1910.)

ELECTRIC street traction was inaugurated in Glasgow in the autumn of 1898, the track from Mitchell Street to Springburn being equipped as an experiment. At that time, the electrical equipment on the cars was partly British Thomson-Houston and partly Westinghouse. The controllers were arranged for electric braking, as recommended at that time by these firms.

The brake, as arranged by the Westinghouse Co., was what is now known as the rheostatic brake, and was simply a circuit which

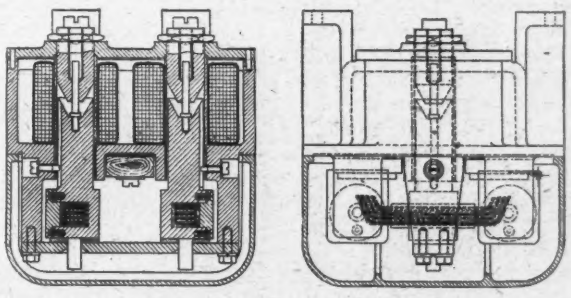


FIG. 1.—WESTINGHOUSE BRAKE SKID-PROOF DEVICE.

included the armatures, field coils and rheostat. The rheostat was gradually cut out as the car slowed down, until the motors, which were working in parallel, were short-circuited on themselves.

The British Thomson-Houston brake was composed of two sets of disks per car; one set of disks, or the brake for one axle, comprised one revolving and one stationary disk. There were embedded in each brake-shoe two magnet coils, which formed part of the electric

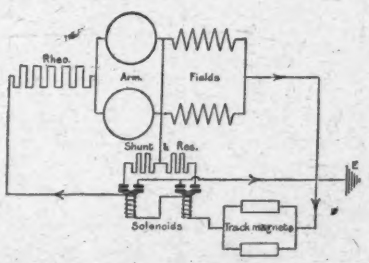


FIG. 2.—CONNECTIONS FOR WESTINGHOUSE BRAKE, WITH DOUBLE SHUNT, EACH CONTROLLED BY A SOLENOID, OPERATED BY A SERIES COIL.

brake circuit, so that when the brake was applied to a moving car, the shoes became magnetised, and drew themselves into mechanical contact with the revolving brake disks.

Ten years have passed since this type of brake was used in Glasgow, as they were removed from all the cars thus equipped, which were then simply connected up for rheostatic braking.

About this time, 1899 and 1900, Mr. F. C. Newell, an American

railway engineer, invented and patented what is known as the Newell brake. The design of this braking apparatus is very ingenious, and was a great stride in the right direction.

In the spring of 1901 the Glasgow Corporation Tramway Department equipped six cars with this type of brake. Some rough tests were then made to find out what it could do. So pleased were they with the performance of the brake that within a very short time every passenger car on the system was equipped with the apparatus.

The brake question then lay dormant for some time, until we began to discuss the probable cause of the damage done to some of our armatures, controllers, &c. A few rough tests were made to find out the voltage across the armature terminals when the brake was applied, and it was found that when running at 18 to 20 miles per hour with 10 ohms in the brake circuit, the voltage was as high as 1,000 to 1,200 volts; the motors are built to operate at 600 volts

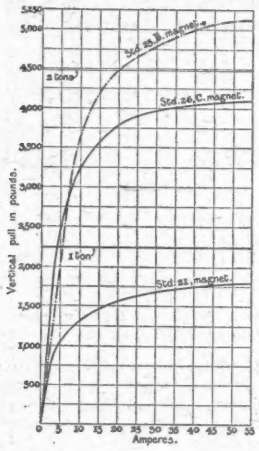


Fig. 3.—Westinghouse Magnetic Brake Curve showing Vertical Pull of various Magnets on Rail.

maximum, so they could scarcely be expected to generate heavy currents at double that voltage without being damaged and occasionally burned out.

Another interesting point was demonstrated by these rough tests, viz., that 17 to 18 miles per hour was the critical speed at which skidding took place, that is to say, with an equipment such as is installed in Glasgow (namely, cars weighing 10 to 11 tons unloaded, equipped with Westinghouse 49B motors, and a resistance of 10 ohms in circuit with first braking-point), momentary skidding took place when the brake was applied even on a level clean rail.

In January, 1908, we began experimenting with a permanent shunt resistance in parallel with the fields when braking, but that idea had to be abandoned, because when a low resistance was inserted in the shunt circuit the motors would not excite, while on the value of the shunt resistance being increased the machines would not excite quickly enough for an emergency stop. Our next move was to introduce the shunt automatically, as required, by means of a solenoid-operated switch. This turned out to be the

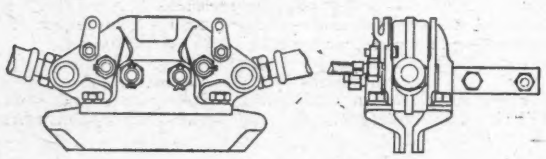


Fig. 4.—Westinghouse No. 26C Magnet.

proper course to follow. It was found that when the solenoid operated with 30 amperes and brought in a shunt resistance of 0·2 ohm we had complete control of the voltage, at least up to 20 miles per hour, without impairing the effect of the brake. The voltage never rose above 600, and, of course, there was no skidding. It was deemed wise to make the solenoid double barrelled (fig. 1). The low-speed solenoid operated at 30 amperes, bringing in a shunt resistance of 0·2 ohm, and the high-speed solenoid at 80 amperes, bringing in another shunt resistance of 0·2 ohm in parallel with the first (fig. 2). In the event of a motorman running his car at, say, 18 miles per hour, and through excitement or carelessness, passing over the first on to the second brake-point of his controller, both solenoids will operate, and thereby bring a shunt resistance of 0·1 ohm in parallel with the fields. This gives the very best results without skidding. It may be mentioned that with this double solenoid control the voltage never rises above 600, no matter what the speed may be.

In order that the very best braking results might be obtained in conjunction with solenoid control, two sets of more powerful track magnets were tested. They are listed by the Westinghouse Co. as 26C and 25B magnets. The curve sheet in fig. 3 shows the relative vertical pull of these magnets as against the old Newell type known as the Standard 21 magnet.

These new magnets are quite different in design from the old Newell magnet, on which the poles follow each other in series on the rail. In the new type the poles are placed side by side and parallel to each other. Fig. 4 represents the new standard 26C magnet. The 25B is similar in design, only larger. The new type of magnet not only gives a far greater maximum pull, but its effect

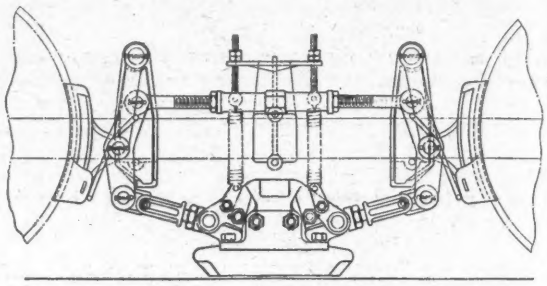


Fig. 5.—Westinghouse Magnetic Brake operated by No. 26C Magnets.

with a current of 5 amperes is greater than that of the old magnet with 50 amperes. The difference in the heating of the motor is most important.

For coasting tests two gradients were chosen, one 200 yards long, with an average fall of 1 in 27, being selected as the easy gradient, while the heavy gradient was 100 yards long, with an average fall of 1 in 13. The following method of obtaining the readings was adopted for the easy gradient test. The test ground 200 yards long was plotted off in lengths of 10 yards, with a distinctive mark every 40 yards. The starting-point was approximately 40 yards behind the first mark. The car, in every test, was started from rest with the controller set on the second braking-point. The starting-point was arranged so that the first peak or maximum reading coincided with the first mark. The time in seconds taken by the car to travel over the test ground was checked by a stop

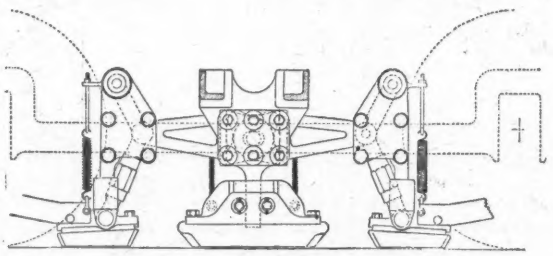


Fig. 6.—"1908" Brake operated by Westinghouse No. 25B Magnets.

watch. The attendants recorded every movement of the instruments, both maximum and minimum. On the heavy gradient the test ground was again plotted off in lengths of 10 yards, but the distinctive marks in this case were every 30 yards, the first one being 10 yards from the top of the incline. In order that the first maximum reading should approximately coincide with the first mark, the car, during these tests, was started by power over the crest of the hill from the test ground; on the very crest of the hill power was switched off, and 5 yards further on the brake was applied on the third braking-point. All other observations were taken in the same manner as on the easy gradient.

The average current required to control the car on the easy gradient was as follows:—

Coasting Test.—Easy Gradient, Rheostatic *v.* Track Brake only (without wheel-shoe attachment).

Type of brake.	Volts.	Amperes.	Per cent. decrease.
Rheostatic only	279·44	36·72	—
Standard 21 magnet	181·43	23·66	35·57
Standard 26C magnet ...	63·88	8·94	75·66
Standard 25B magnet ...	60·83	8·00	78·22

Coasting Test.—Heavy Gradient, Rheostatic *v.* Track Brake only (without wheel-shoe).

Type of brake.	Volts.	Amperes.	Per cent. decrease.
Rheostatic only	295·66	63·27	—
Standard 21 magnet	238·33	49·66	21·5
Standard 26C magnet ...	164·80	34·25	46·0
Standard 25B magnet ...	122·93	25·25	60·1

For coasting tests on combination track and wheel brakes, four cars with similar bodies and electrical equipment were employed.

The brake-gear fitted to the different cars was the following :—

Car No. 368, Brill single truck, Newell brake-gear and old standard 21 magnets.

Car No. 687, Brill single truck, Newell brake-gear and new standard 26C magnets (fig. 5).

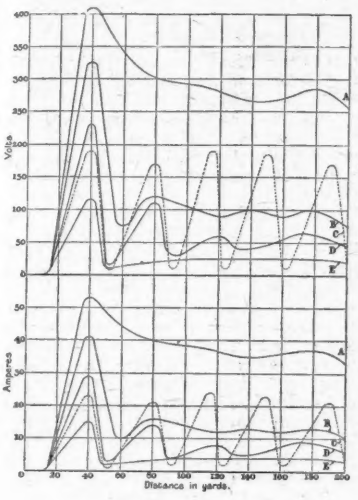
Car No. 438, Mountain & Gibson radial axle truck, Newell brake-gear, new standard 25B magnets.

Car No. 782, Brill single truck, different type of brake, placed upon the market during the year 1908, and magnets 25B.

reduced from 82·1 to 65·8, and the amperes from 17·0 to 13·6, while the average time taken to descend the gradient is also reduced from 47½ to 46 seconds.

Great trouble was experienced with surging. When car No. 782 was coasting down the steep gradient (fig. 8) it was almost brought to a standstill every 10 to 15 yards. The current then died away, and the suspension springs lifted the magnets clear of the track. The car plunged forward again, and so on. Regarding car No. 438 (fig. 9), the trouble with it was caused by the powerful magnets operating on a weak radial-axle truck.

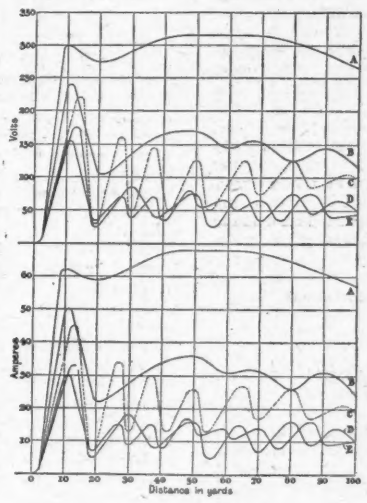
Brake stop tests were confined to moderately high speeds, such as



(Easy gradient: Average fall, 1 in 27.)

A, Coasting on rheostat only; B, car No. 368; C, car No. 782; D, car No. 438; E, car No. 687.

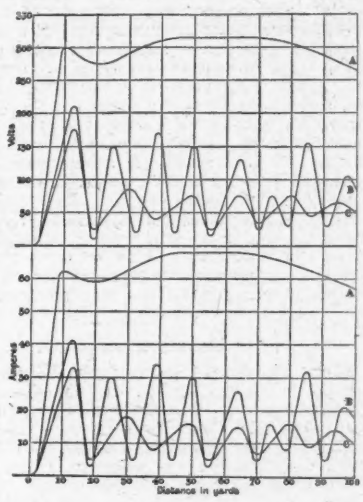
FIG. 7.—COASTING ON COMBINATION BRAKES.



(Heavy gradient: Average fall, 1 in 13.)

A, Coasting on rheostat only; B, car No. 368; C, car No. 782; D, car No. 438; E, car No. 687.

FIG. 8.—COASTING ON COMBINATION BRAKES.



(Heavy gradient: Average fall, 1 in 13.)

A, Coasting on rheostat only; B, car No. 438; C, car No. 438, with solenoid-controlled fields.

FIG. 9.—COASTING ON COMBINATION BRAKES, WITH AND WITHOUT SOLENOID CONTROL.

In this brake the motion obtained from the movement of the magnets was utilised in pressing auxiliary track-shoes down on the rail, instead of applying auxiliary wheel-shoes (fig. 6).

COASTING TEST.—EASY GRADIENT, RHEOSTATIC *v.* COMBINATION BRAKES (Fig. 7).

Car No.	Type of brake.	Volts.	Amperes.	Per cent. decrease.
Average	Rheostatic only	279	36·00	—
368	Newell and Standard, 21 magnet	96·10	12·66	64·90
782	"1908" and Standard, 25B magnet	83·00	10·50	70·90
438	Newell and Standard, 25B magnet	56·10	7·44	79·34
687	Newell and Standard, 26C magnet	24·66	3·47	90·36

This test illustrates the superiority of the standard 26C magnet when the current is low.

COASTING TEST.—HEAVY GRADIENT, RHEOSTATIC *v.* COMBINATION BRAKES (Fig. 8).

Car No.	Type of brake.	Volts.	Amperes.	Per cent. decrease.
Average	Rheostatic only	295	63·00	—
368	Newell and Standard, 21 magnet	144·50	30·10	52·3
782	"1908" and Standard, 25B magnet	97·94	21·00	66·6
438	Newell and Standard, 25B magnet	65·83	13·60	78·4
687	Newell and Standard, 26C magnet	61·05	13·28	79·0

Attention may now be drawn to the beneficial effect of the solenoid control in coasting on the steep gradient, where the current occasionally exceeds 30 amperes and so causes the solenoid to operate. In fig. 9 we see that under solenoid control the initial surge is checked, the voltage being reduced from 210 to 175, and also that the back-kick is less pronounced, being 25 against 15. The whole reading is more uniform throughout, the number of complete waves being reduced from 8 to 6, the average voltage

17, 18 and 19 miles per hour, on a track with an average fall of 1 in 108. Many preliminary tests were made, but it will be sufficient to indicate only the results of the final test between car No. 782, equipped with the 1908 brake-gear, operated by 25B magnets, and car No. 687, equipped with Newell brake-gear, operated by 26C magnets under solenoid control. The two cars are alike in general construction and equipment, but car No. 782 weighs 2½ cwt. more than car No. 687. This is accounted for entirely by the difference in weight of the two brake equipments. The state of the rails when the test began was perfect. Throughout the test no sand was dropped on the rail to assist retardation. At each speed three service stops and three or four emergency stops were made.

STOPS AT 17 MILES PER HOUR.

Car No.	—	Stop distance.	Maximum volts.	Maximum amperes.	Retardation.
782	Service stop	60 ft.	875	110	5·43
687	" "	57 "	475	70	5·70
782	Emergency stop	34½ "	875	190	9·28
687	" "	36 "	475	140	8·90

At 18 miles per hour we find that car No. 782 always skids once, and sometimes twice, during every service stop, whereas car No 687 shows no sign of skidding.

STOPS AT 18 MILES PER HOUR.

Car No.	—	Stop distance.	Maximum volts.	Maximum amperes.	Retardation.
782	Service	70½ ft.	1,025	200	5·19
687	"	70½ "	525	90	5·19
782	Emergency	52½ "	1,125	165	6·85
687	"	52½ "	535	150	6·85

At 19 miles per hour it became impossible to record the readings for car No. 782, as the first skid always took place before the instrument had time to indicate the true voltage. Regarding the stops made by car No. 687 at this speed, both service and emergency, the voltage never rose above 595, and even when making the last two emergency stops, when the controller handle was passed right over the first braking-point, on to the second, there was absolutely no indication of skidding.

Regarding the brake on car No. 782, it has been conclusively proved by our tests that it can bring a car to rest in an extremely short distance, but the retardation throughout an emergency stop is

the reverse of uniform. Retardation to this extent would very soon ruin the framework of a car body, and create no end of claims from injured passengers. What is wanted is uniform retardation throughout the stops. Retardation from car No. 687, in our opinion, was perfectly uniform throughout the most severe emergency stops, being as high at the beginning as at the end of the stop. It makes very little difference in the voltage whether the controller is properly handled or not. The increased heating due to braking with the latest type of magnet is practically nil. If, in addition, the motor fields are provided with solenoid operated shunts, excessive voltage cannot occur, and the objections to the use of the motors for electric braking have been removed.

From actual experience gained, the author is of the opinion that automatic solenoid control of the field, such as has been described, is a valuable addition to the brake-gear of an electric car. The Glasgow Corporation Tramways Department is at present engaged in fitting to each car an automatic sanding apparatus, the component parts of which are a solenoid and a continuous-flow sand valve. The coil of the solenoid is inserted in the main braking circuit, and its armature is connected to the continuous-flow sand valve, so that, when the solenoid operates, the sand valve is opened, and a copious supply of sand is projected on the rail without any effort from the motorman. A spiral spring is attached to the valve in such a way as to work against the action of the solenoid, and adjusted so that if the electric brake is applied for an ordinary service stop, or for coasting, the solenoid is prevented from opening the valve and serving out sand when it is not required; but in the event of the motorman making an emergency stop, the current flowing through the circuit is sufficient to operate the solenoid and automatically to supply sand at a most opportune moment

Discussion at Glasgow.

MR. JOHN FERGUSON (chief engineer, Glasgow Corporation Tramways) said electric braking had not been adopted on some systems, for various reasons. The first was that if a brake was applied quickly, especially at high speeds, the tendency was to stop the wheels from revolving, and cause a skid. The second was that its frequent use at any speed, especially at high speeds, tended to increase the maintenance cost of the equipment generally, but especially of armatures, and also had a serious effect upon car bodies—straining them considerably. The third objection was that it depended for its action upon a number of controller contacts which were liable to get out of order, and the fourth was that it could only be applied when the car was in motion; one could not tell whether it was in order when the car was stationary. These difficulties existed in any form of electric traction brake. He thought that the solenoid control had effectively removed the first two objections—at any rate, it had effectively removed the skidding objection—and he thought, on account of the greatly reduced demand upon the motors, that the armature maintenance cost would be materially lessened. They had not had a long enough experience or gone far enough in the direction of solenoid control to tell what the reduced maintenance cost would be, but from figures given of low voltages and currents, there could be no question at all that it had had a very beneficial effect upon equipment. The elimination of skid was a great step in advance, and would be highly appreciated by a motorman when he understood that he could apply his electric brake as quickly as he liked without skidding the wheels when called upon to make a sudden or emergency stop. The paper, however, did not claim that either the third or the fourth objection had been removed. After seven or more years' experience in Glasgow, they had not found that these objections amounted to much. The average number of times an electric brake was applied in the course of a day with a car running 120 miles was almost one application, while the number of reports received during 1909 of defective electric brakes amounted to about 17—the greater proportion being not really defects in the brake but defects in the application of the brake.

MR. M'WHIRTER (Glasgow) said that the solenoid principle removed most of the difficulties, and kept down the rise in voltage at any given speed. The result of its adoption would be a great saving in motors and armatures, to say nothing of power. The rise of voltage was altogether due to the design of the motor fields. While Mr. Gerrard had shown them the results of experiments for stopping quickly at high speeds, stopping at low speeds was just as essential.

MR. ROBERTSON (Glasgow) held that the combination of the hand brake and the electric brake was not a satisfactory one in a city like Glasgow. He approved of the fitting of a combination of air and electric brakes.

PROF. BAILEY (Edinburgh) suggested that the surging of a car was due to the sluggishness of the electromagnet. He asked if Mr. Gerrard had tried air-gaps in the electric track magnet to hasten both the coming-on and the going-off of the brake and reduce pulsations of speed. The voltage increase it was impossible to avoid. The car must be built to run at, say, eight miles an hour, with its brake saturated with the full current, and if they ran at 20 miles an hour at the same voltage, he did not know of any manufacturer who could get out of that difficulty.

MR. M'MILLAN was of opinion that if they departed from the electric solution of the braking question they must seek for it in compressed-air control, in which they would follow the Westinghouse principle. Glasgow cars were too small for air brakes.

MR. STEVENSON thought they might have had some information as to the cost of the various braking devices, and the extent of the wear and tear.

In the course of his reply, MR. GERRARD said they got a high retardation from the large magnet, but it was too erratic in coasting and in creating the surging effect, and they had to part with the powerful magnet to get steady coasting. There was no trouble in getting high retardation at low speeds. They could use the electric brake down to three miles and make a cleaner stop than with the hand-brake. A badly trimmed brake might induce surging; the best way to reduce it was the introduction of solenoid control. They had never introduced air gaps on both sides of the coil, though they had increased the air gaps between the poles. He thought that in braking they had come to the point beyond which they could not go very much further. He could not give the cost of braking devices or of operating; they had not worked the cars long enough upon that system to be able to give information on the point. As they only applied the electric brake for emergency work, the wear and tear was not so great upon the Glasgow system as upon others.

Discussion at London.

MR. J. S. PECK, in opening the discussion, said the brake question slumbered when there were no accidents, but it would come forward again at intervals, so long as the human element entered into the question. The devices mentioned by the author prevented some of the damage which might occur with such equipment. He believed that Glasgow had exceptionally low maintenance costs with its equipment, but had found it beneficial to investigate the brake question further.

MR. E. COCKSHOTT said that the author's 1908 brake was the Maley brake, which was in use on several cars in Leeds. Tests at Leeds showed that the Westinghouse brake (apart from the solenoid device) had a tendency to skid, and he instanced a case where a car with that brake had skidded 130 yards down a grade of 1 in 11, only pulling up at the bottom of the hill. The solenoid device would probably prevent this skidding, but he believed that the Maley brake would do the same. The real test for brakes of this kind was to excite the magnet from the trolley line and drag the car along through a spring balance, so as to measure the force required to move a car against the fully-applied brakes only. The Leeds tests showed practically the same drag in each case. He could not understand the author's figures, as up to 28 miles an hour, with the Maley brake at Leeds, the voltage did not exceed 890. The surging effect was not noticed at Leeds, where some 30 Maley brakes were used.

MR. A. W. MALEY (inventor of the Maley brake) said the author's conclusions were at variance with those which would be drawn from experience with the 1908 brake at Leeds and Birmingham. The comparative results were misleading in view of the careful tests made at Leeds, on behalf of the Tramways and Light Railways Association, by Mr. Fell, which were favourable to that brake. The newer Westinghouse brake was a great step forward, but the solenoid control was 10 years old, and if it possessed the advantages claimed, it was strange that it had not made more progress. He thought the author was rather unfair in not identifying the 1908 brake as the Maley brake.

MR. W. H. BOOTH said it was generally admitted that an electrical brake should have a mechanical stand-by; he described the action of the Freund Tumbler brake (which has appeared in our pages), and asked the author if he could differentiate between magnetic and mechanical braking effects in retardation. He thought that cast-iron brake blocks, in view of their greater efficiency, were worth a trial.

MR. H. M. SAYERS said that the outstanding difference between the magnetic and mechanical brakes was that the retarding effect of the former was independent of the weight of the car. In mechanical braking the retardation was a function of the coefficient of friction and did not approach the 8 or 10 ft. per sec. per sec. obtainable with the magnetic track brake. The maximum attraction with a magnetic brake was 200 lb. per sq. in., and so the retarding effect was only limited by the comfort of the passenger. The newer Westinghouse brake magnets only required some 10 or 15 per cent. of the power required by the earlier ones. Brake tests made in different places and by different people could not be expected to give consistent results, and the difference between the Leeds and Glasgow results with the Maley brake showed that some essential difference in conditions existed, which was not mentioned by the author. The Maley brake should not be judged from the paper, as he could speak as to the excellent results obtained with that brake at Leeds. The magnetic brake, with solenoid control, appeared to meet the severe conditions of heavy traffic as nearly as possible, but it was a complicated apparatus. It was necessary that the contacts in the solenoid should be kept clean, as this affected the whole working of the car. He did not think a magnetic brake was the best for heavy gradients; a mechanical brake was better and far cheaper.

The AUTHOR, in reply, said the paper emphasised the value of the solenoid as a current limiter, but he did not think this device would be effective in preventing skidding with the Maley brake; the latter had a see-saw action, partly mechanical and partly electrical, and he did not see how skidding was to be avoided with it. For obvious reasons, he had not mentioned the Maley brake by name.

Victoria Turbo Pumps.—We are asked to state that MESSRS. WILLANS & ROBINSON, LTD., have now made arrangements for dealing with inquiries for their turbine pumps, and in future all inquiries should be addressed direct to their Victoria Works, Rugby. Although the Victoria pump has only recently been placed on the market, some 20 pumps have already been built, ranging in size from 9,400 gallons of water per minute down to 150 G.P.M. The pumps already built are designed for dealing with effective heads from 35 ft., in some sizes, up to 535 ft. in others.

GERMANY AND PROTECTIVE DUTIES: AN ADVOCACY OF LOWER IMPOSTS.

THE subject of foreign trade and Customs policy is discussed at some length by Dr. E. Roghé, of Berlin, in the *Elektrotechnische Zeitschrift* of April 28th. After reviewing the position of affairs in various countries, most of which are governed on the system of high protection, the author refers to Great Britain, which he characterises, together with the British Colonies, as the most important exception to this practice. As is known, the large self-governing dominions—Canada, South Africa, Australia and New Zealand—conduct their own commercial policy, which for some time past has been in the direction of a more or less expressed system of protection. But Free Trade has prevailed in the Mother Country for half a century, and a majority of the electors at the Parliamentary election this year declared themselves satisfied with it. Of course, the opposing minority was of considerable strength, and it seems by no means out of the question that it will not grow to a majority in the future. Apart from the sphere of Customs duties, there is also no lack of a completed legislative step in the direction of State protection of British industry in the sense of the Patents and Designs Act, 1907, the compulsory-working clause of which has already led to the investment of large sums of foreign, including German, capital in English works, and to the transplantation of foreign foremen and workmen to that country to instruct British workmen in the methods of production concerned, or to the grant of licences on low terms, or to the appropriation of processes in cases of the forced lapse of patents.

As a result of the higher Customs walls raised throughout the world, which British exports are only able to surmount with difficulty, the author suggests that it is no wonder that the British Lion should endeavour to treat like with like, and, in the possession of "negotiation duties," see whether the other countries can be compelled to reduce their duties by means of treaties. A defensive object is associated with the aggressive purpose. The industries of protectionist countries are accustomed to utilise their assured inland market in order to fully cover their general working expenses, but to sell abroad at prices which only meet the special expenses together with a rate of profit that is often very low. The British manufacturer consequently variously encounters in his own country an underselling competition by the Continent, against which he demands a protective duty, at least in the form of a dumping clause according to Canadian pattern, which imposes on foreign goods which are sold to Canada under the home market value an equalising duty represented by the difference between market value and purchase price. The third, and perhaps the most effective, support of the English protectionist movement is that of a closer association of the individual parts of the British Empire from a political-economic point of view. The large dominions have taken the lead in this way, as each has granted to the Mother Country, as well as to other British colonies, duties giving a preference over all non-British countries. The Mother Country, which only levies duties for revenue purposes, is unable to concede preferential duties to the colonies, and consequently owes reciprocal treatment to the latter for the time being. In the long run this relationship must go to ruin. But strong sympathies are manifested in the Mother Country in the idea of an Imperial Customs Union for general political reasons more than for economic-political reasons, which sympathies in the case of many persons should finally overcome the scruples against the granting of reciprocal treatment in the form of duties on competitive articles from other countries, such as corn, sugar, &c.

The contrary reasons are for the time being still more powerful. The Free Trade idea is firmly anchored in the public opinion of the British nation. Its general enforcement prevents the crumbling away—the introduction of individual duties according to requirements and power of individual groups as is so frequent in protectionist countries. The Englishman is still able to perceive clearly that the grant of a single protective duty would call upon the scene the equally justified claims of all other industries. He has fear that is well founded of starting the fight of all against all, in connection with which every branch seeks to obtain as high a duty as possible for its finished products in the hope that the total increases in prices which he must agree to for his raw and semi-finished materials that are also probably protected by duties, will remain less than the advance in prices realised by himself. In order to meet this objection, the representatives of Customs protection demand chiefly a uniform rate of duty of about 10 per cent. of the value of the goods, and eventually a surtax to equalise slaughter prices.

It cannot be expected that the problem of an Imperial Customs Union will be dealt with alone. This would be very desirable for German industries as the British colonies chiefly export to the Mother Country food products and industrial raw materials. If these were subject to duty when originating in non-British countries, but were admitted free or only liable to lower duties when obtained from British districts, the British colonies would have the pre-eminence sought for, though the exports from industrial countries would by no means be touched, but the industries in the Mother Country raise the greatest opposition to this solution, because the cost of production, especially wages, would be increased by duties on raw materials and food products, and would render competition with the Continent still more difficult. As a consequence, the English industry would at once demand for those duties an equalisation by duties on the goods of the kind of its own products. But in the meantime greater advantage is seen in the continuance of the general freedom from duty, which gives the industries the powerful benefit of the cheap and great market for all raw materials and semi-finished articles, and of the non-burdening of wages with artificially increased prices for the necessaries of life, which already alone often again counterbalance the otherwise acquired advantages of Continental competitors. Intelligent manufacturers also by no means wish to see foreign rivalry in the British market removed, because it is adapted to impart a useful incentive to the somewhat conservative British industry, which is more easily satisfied with that which has been attained, and is less inclined to progressive innovations.

The author, proceeding to refer to the interchange of commodities between different countries, mentions that the value of the German electrical exports in 1908 amounted to £8,850,000, and that of those in 1909, according to the provisional estimates, was £9,550,000. Statistics are, however, only able to prove the fact of the exports, but not the conditions which are of determining importance for the appreciation of the exports from a business and national economic standpoint. Customs barriers may perhaps have remained without importance in many cases where the question concerns the acquisition of special articles in demand, patented products, &c., in connection with which the buyer is ready to pay the amount of the duty levied by his country on the price. But in the by far preponderating bulk of the industrial products exported from Germany, the German exporter is by no means in so favourable a situation, but can only obtain foreign orders at a considerable sacrifice in prices—often only by renouncing the due share of general working expenses—solely for the purpose of maintaining the extent of working and of affording employment to the workmen. Sales of this kind, which appear as "slaughter sales" from the point of view of the importing country—Great Britain for instance—may exist in regard to a large portion of the German exports, and it is misplaced if official and officious defenders of the German high protectionist duties seek to prove with the export figures that the commercial policy of the country has brilliantly solved its problem.

The growing fact of the emigration of industry shows among others that matters are not arranged the best. Undertakings which are financially strong have found it advantageous to erect works of their own in countries having an expressed protectionist policy, and to equip them with German preliminary workers, foremen and higher officials, or to participate financially in existing foreign establishments. The branches, subsidiary companies, and similar activity of German electrical engineering and chemical firms in Russia, Austria, Hungary, France, and the United States are the best-known examples, whilst others exist in many other branches. The result is the development of dangerous competition abroad, which can remain powerful also if the foreign country should later on reduce its duties. That the latter should not take place must be wished by the parent firm from the moment of the formation of the branch, as it would see danger to the capital invested without the Customs protection. The decentralisation of working according to countries is not at all satisfactory for the industrial capital, as centralisation and bulk production and distribution yield larger profits than under the former system. In addition, the branches in foreign countries are liable to the danger that their Governments may one day only tolerate their own subjects as managers and employers, and may expel the foreigners.

The reduction of the highly-raised duties, in the opinion of the author, thus remains in every respect the object which must be worked for. As to the question as to whether Germany could defeat protected competitors and force their way into their country, reference is made to the United States, which impose a duty of 45 per cent. *ad valorem* on electrical products. If Germany retaliated by the introduction of a similar rate, it would lead to a tariff war on account of undue discrimination, and the 45 per cent. duty would consequently have to be applied to all countries. This would naturally raise distrust in other countries which export electrical manufactures to Germany; and if they followed the same principle as adopted by Germany towards the United States, there would arise a Customs wall of 45 per cent. all round—a policy of reprisals which would consequently solely make things worse. On the other hand, the policy of meeting other countries may rather be expected to lead to success, and only when Germany can decide to make real concessions to foreign countries and really open to them fresh access to her market, will equal concessions be obtained from them. Two tariff revisions in an upward direction have already been made by Germany, and Dr. Roghé suggests that she should now take the initiative for a revision in a downward direction if the expiration of the treaties of commerce will give the occasion to do so.

It may appear bold to now raise the belief that the fortunate possessors of the privileges of protective duties in various countries would renounce them or be compelled to do so by legislation. But such a belief by no means lacks support. The protected industries will not be able to exclude the idea that protective duties yield a profit (of very doubtful legitimacy) so long as they are reserved for individual industries and countries, but that this profit is again destroyed by losses on the other hand as soon as protection becomes general. In this connection, the transition of Great Britain to protective duties and the associated damming of the sale of Continental industry could indeed contribute towards opening the eyes of the advocates of the system of Protection. But, on the other hand, consumers are becoming more and more conscious of the immense burdens which are imposed upon them by duties, and they will learn to use their power to shake them off. Pending the

expiration of European treaties of commerce, most of which are first denounceable at the end of 1917, Dr. Roghé suggests that all professionally concerned, especially the Press in all countries, have the important duty of drawing attention to the danger of suffocation which is concealed in the atmosphere of protective duties, and of thus preparing the way of public opinion in the producing of national groups, as well as of the great mass of consumers, for a return to a more free international interchange of goods.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PHILIPPINE ISLANDS.

	Ad val.
Asbestos and manufactures thereof, not elsewhere provided for in the tariff	15 %
Mica and manufactures thereof	25 %
Porcelain, &c., in articles not elsewhere provided for in the tariff, not painted, glazed, decorated nor ornamented	20 %
Earthenware, plain	25 %
Manufactures of glass, not elsewhere provided for in the tariff	35 %
Iron or steel rails, portable tramways, &c.	40 cents per 100 kg.
Wrought-iron or steel wire :	
(*a*) More than 1 mm. in diameter, plain, galvanised or coppered, wire cables and ropes, and barbed wire ...	10 %
(*b*) 1 mm. or less in diameter, plain, galvanised or coppered, and wire netting	15 %
(*c*) Other, including those covered with textiles ...	25 %
Copper and alloys thereof in wire :	
Plain	15 %
Blanched, gilt or nickelled	25 %
Covered with textiles, not otherwise provided for, or with insulating materials, cables for conducting electricity, and trolley wire	10 %
Covered with silk, not otherwise provided for ...	25 %
Manufactures of copper or alloys thereof, not otherwise provided for :	
Plain, polished, varnished, painted, tinned or japanned	20 %
Other	25 %
Electric and electro-technical machinery, apparatus and appliances :	
(*a*) Dynamos, generators, generating sets, alternators, motors and similar machinery, not otherwise provided for, transformers and storage batteries, switchboards and switches, arc lamps, telephone and telegraph instruments, fans, buzzers and annunciators, ammeters, voltmeters, wattmeters and similar measuring apparatus, dry and wet batteries, and detached parts for any of the foregoing, and articles used exclusively in the installation thereof, insulators, and insulating compounds and materials used exclusively for electrical purposes, carbon, and incandescent bulbs and tubes...	10 %
(*b*) Cooking and heating apparatus and utensils, chandeliers, desk and table lamps, flatirons, soldering and curling irons, thermo-cauteries and cauterising instruments, surgical, dental and therapeutic appliances, including so-called electric belts, X-ray machines, vibratory apparatus, electro-plating outfits, cigar lighters, other instruments, implements, utensils and articles used in connection with, for, or by the application or production of electro-technical, thermo-electric, galvanic or galvano-magnetic force, and detached parts for any of the foregoing, not otherwise provided for	20 %
Engines, motors, steam boilers, pumps and machinery, not otherwise provided for :	
Of iron, steel or wood	15 %
Of other materials	20 %
Machine belting	10 %
Vehicles for use on railways or tramways	10 %
Scientific apparatus, not separately provided for ...	25 %
Submarine telegraph cables	free

To Help British Trade in South Africa.—As we stated some little time ago Mr. R. Sothern Holland, H.M. Trade Commissioner for South Africa (address P.O. Box 1,346, Cape Town), is in the Information Bureau that he has established at his office, doing his utmost to bring British firms and their manufactures under the attention of buyers in that part of the world. We learn that many manufacturers are taking interest in the advantages offered by the Bureau, every mail taking to him large numbers of catalogues and other information useful to Colonial buyers, but Mr. Holland is anxious for *all* to benefit, and we would urge firms who desire to gain a hold on, or increase their present standing in, South Africa, to take full advantage of the present opportunity.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and 6 Liverpool and Bradford, to whom all inquiries should be addressed.

15,929. "Method of enclosing the arc of arc lamps." J. W. Nasmith (Tito Livio Carbone, Germany.) (Application for Patent of Addition to No. 17,448 of 1909.) July 4th. (Complete.)

15,933. "Improvements relating to holders for electric incandescent lamps." R. F. Russell and E. T. Hutson. July 4th. (Complete.)

15,968. "Device for mounting the sparking plugs of internal combustion engines." J. C. Light and D. R. Anthoney. July 4th.

15,977. "Improvements in or connected with electrodes for arc lamps." F. M. Lewis. (Date applied for under Rule 13, August 10th, 1909, An invention comprised in Application No. 18,469, dated August 10th, 1909.) July 4th.

15,988. "Improvements in electric cut-outs." M. J. Railing and C. C. Garrard. July 5th.

15,993. "Improvements in the method of and in apparatus for controlling the speed of electromotors." Electromotors, Ltd., and E. Greenhalgh. July 5th.

16,017. "Improved detachable power handle for controllers on electric cars, cranes and the like." W. R. Shaw and G. H. Green. July 5th.

16,019. "Improvements in telephone exchange systems." British Insulated and Helsby Cables, Ltd., and J. B. Redfern. July 5th.

16,021. "Improvements in electrical transmission of half-tone or line photographs." H. W. H. Palmer. July 5th.

16,043. "Improvements in and relating to imperfect contact resistance devices." H. T. Jones. July 5th. (Complete.)

16,063. "Improvements in the manufacture of electrodes for secondary batteries or storage cells." Serge Berditschewsky Apostoloff and V. de Karavodine. July 5th.

16,067. "Improvements in or relating to electrolysis." H. Arledter. July 5th.

16,093. "Improvements in electric ignition apparatus for internal explosion engines." R. F. Hall. July 6th.

16,113. "Improved electric switching device." J. Wilkes. July 6th.

16,152. "Improvements in electrical switching mechanism." E. T. B. Murray. July 6th. (Complete.)

16,219. "New or improved electric service supply unit system and apparatus therefor." H. Gray. July 7th.

16,256. "Improvements in and relating to the production of resinous derivatives particularly adapted for insulating electric cables and the like purposes." W. E. Lake. (Standard Chemical Co., United States.) July 7th.

16,257. "Improvements in electric switches." C. H. Merz. July 7th.

16,258. "Improvements in electric safety fuses." M. Kallmann. July 7th. (Complete.)

16,259. "Improvements in and relating to the production of resinous compounds particularly adapted for insulating electric cables and the like purposes." W. E. Lake. (Standard Chemical Co., United States.) July 7th.

16,260. "Improvements in and relating to the preparation of insulating compounds." W. E. Lake. (Standard Chemical Co., United States.) July 7th.

16,329. "Improvements in a central energy electrical signalling system." J. C. Francis. July 8th. (Complete.)

16,330. "Improvements in a central energy electrical signalling system." A. Goldstein and C. Pool. July 8th. (Complete.)

16,331. "Improvements in a central energy electrical signalling system." A. Goldstein. July 8th. (Complete.)

16,332. "Improvements in a central-energy electrical signalling system." A. Goldstein. July 8th. (Complete.)

16,333. "Improvements in a central energy electrical signalling system." A. Goldstein. July 8th. (Complete.)

16,334. "Improvements in a central energy electrical signalling system." A Goldstein. July 8th. (Complete.)

16,336. "Improvements in a central energy electrical signalling system." A. Goldstein. July 8th. (Complete.)

16,377. "Improvements in and relating to electrical insulators." H. W. Brady and C. C. Hatry. July 8th.

16,342. "Frequency meters for direct reading of or recording the frequency in alternating current circuits." Siemens & Halske Akt-Ges. (Date applied for under Sec. 91 of the Act, July 24th, 1909, being date of application in Germany.) July 8th. (Complete.)

16,345. "Improvements in or relating to switch throwing mechanism." H. Shemwell. July 8th. (Complete.)

16,354. "Improvements in apparatus for producing electrical impulse charges for wireless telegraphy and telephony." S. Eisenstein. (Application for Patent of Addition to No. 10,019, 1908.) July 8th. (Complete.)

16,356. "Improvements in apparatus for producing electrical impulse charges for wireless telegraphy and telephony." S. Eisenstein. (Application for Patent of Addition to No. 10,019, 1908.) July 8th. (Complete.)

16,360. "Improvements in or relating to wireless operated electrical signalling indicating or like means." L. Cerebotani. (Date applied for under Sec. 91 of the Act, February 24th, 1909, being date of application in Germany.) July 8th. (Complete.)

16,364. "Improvements in apparatus for producing electrical impulse charges for wireless telegraphy and telephony." S. Eisenstein. (Application for Patent of Addition to No. 10,019,08.) July 8th. (Complete.)

16,367. "Improvements in composite magnets." A. Keller-Dorian. July 8th. (Complete.)

16,371. "Improvements in and relating to sparking gaps." S. Eisenstein. July 8th. (Complete.)

16,404. "Improvements in electric cut-outs or fuse switches." J. Hill. July 9th.

16,419. "Improvements in inductive wireless telephone installations." E. von Kramer. July 9th.

16,424. "Improvements relating to alternating current dynamo-electric machines of the commutator type." M. Milch. July 9th.

16,444. "Telegraphy." E. S. Heurtley. July 9th.

16,451. "Improvements in and relating to electric glow lamps." H. Grier. July 9th.

16,457. "Improvements in and relating to sparking plugs for internal combustion engines." E. Schneider. July 9th. (Complete.)